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VIEWS, NEWS AND INTERVIEWS.

The defenses which Andrew Carnegie's steel company at Homestead, Pa., have provided against the attacks of strikers consist of a number of large pumps, plenty of water and hose, powerful electric search-lights to prevent night assaults, and a barbed wire fence around the plant which may be charged with electricity. The strikers have been using these defenses with marked success.

Gottlieb Chrystal and Arthur D. Colby, two New York electricians, thought it would be proper to celebrate the Fourth of July by exploding cannon fire crackers in an elevated railway car and by throwing lighted crackers from the car into the street. The performance was properly concluded by the arrest of the two electricians when the train reached South Ferry.

Nine-tenths of the houses now in process of construction in Indianapolis are being fitted up with electric light wires.

General Grant, Assistant Secretary of War, announces that the War Department will exhibit several novelties at the World's Fair, one of which will be a war telephone service, the wire being paid out of the knapsack of a soldier as he goes to the front. There will also be observation balloons, with telephone wires hidden in the ropes which hold them captive.

Have you noticed how the *personnel* of the electrical field is constantly changing? What is the cause? Combinations and condensations. And the cause of these? Progress.

Mt. Vernon needs a general religious shaking up, and the *Gleaner* is pleased to know she has had it. The town was in too great a hurry in expending its wealth on an electric light plant. A truly good town has no need of electricity. See?—*Henderson, Ky., Gleaner.*

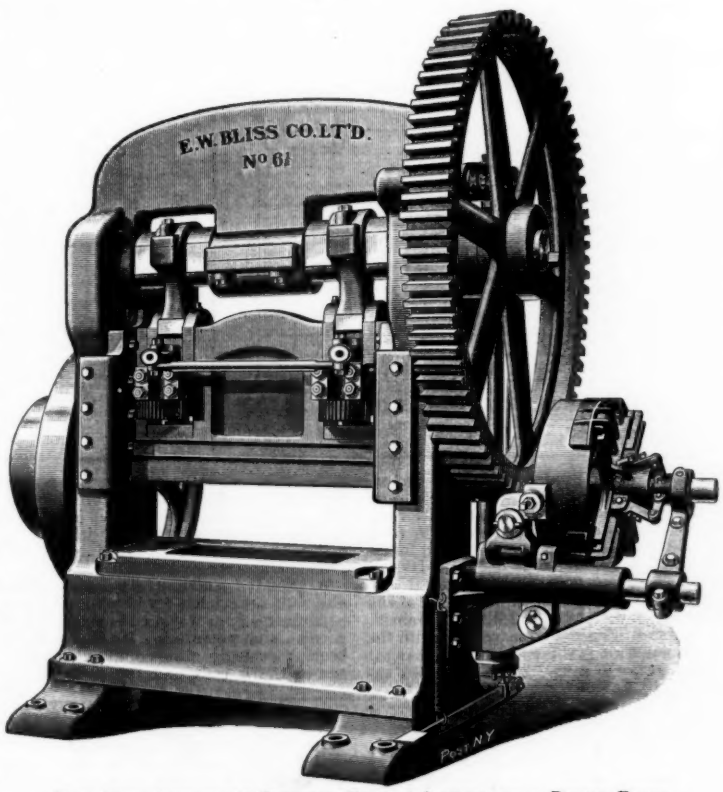
Yes, General, the light of religion renders unnecessary any other illuminating power to guide us in our journey of life. The Lamp of Zion shines with such brilliancy on Mt. Vernon that we feel just like reaching out to save Brother Haag from the wrath to come. Yes, brother, its effulgent rays are so far reaching and rarefying that, with a little self-sacrifice, you will be enabled to remove the beam from thine own eye. There is more rejoicing over the sheep that was lost and is found than over the ninety and nine that went not astray, so when Henderson comes into the folds of the righteous the rejoicing shall be great.—*Mt. Vernon, Ky., Democrat.*

The rumor that reciprocal relations would be established between the Western Union and the Postal Telegraph Companies is officially denied. The Postal Company is to erect a 12 story building, to cost $750,000, at the corner of Broadway and Murray streets, New York, excavations for which are now being made.

Officials of the New England Telephone and Telegraph Company deny the rumors that a strike of their employés is pending.

The Bliss Automatic Friction Clutch.

The application of this automatic friction clutch represents a radical departure and a great advance in the construction of power presses. It obviates entirely many of the difficulties experienced with the regular automatic clutches in heavy power presses. It will be understood that with the regular automatic clutch the driving wheel revolves freely on the shaft until a pressure on the foot treadle, by releasing a key or similar device, establishes a sudden connection between them. Where the slide is heavy and has to be kept tight in the guides, the shock resulting from this sudden impact acts like a sledge hammer blow on the clutch parts, calling for frequent repairs and causing vexatious delays.



THE BLISS AUTOMATIC FRICTION CLUTCH APPLIED TO A POWER PRESS.

The construction of the automatic friction clutch, which avoids these difficulties, will be understood from the annexed illustration of a press adapted for very heavy forming, forging and punching. A pressure on the foot treadle shown releases a weight, which actuates a powerful friction clutch. In order to avoid too sharp an action of this weight, it is connected at its lower end with a dash pot.

After the shaft has made one complete revolution a cam releases the friction clutch, bringing into action at the same time a brake, and thus stopping the slide at the highest point of the stroke.

The large gear wheel, instead of revolving continuously, is, with these new clutches, keyed on to the shaft and at a stand-still until the clutch is thrown into action. This constitutes an additional advantage in the saving of considerable wear on the shaft and wheel hub.

There is nothing about these clutches which is liable to get out of order, and for whatever wear may be occasioned by continuous use easy means of compensation are provided.

The press shown is one of a series of 11 sizes. It weighs about 25,000 pounds, and has 54 inches between the uprights, thus adapting it for gang punching, the operation of cutting and forging dies set side by side and long bending dies. This machine is manufactured by the E. W. Bliss Company, Limited, No. 14A Adams street, Brooklyn, N. Y.

Brush Company Wins.

The Supreme Court handed down its decision at Cincinnati, June 21, on the motion for leave to file a petition in error made by Corporation Counsel Horstman on behalf of the city of Cincinnati against the Brush Electric Light Company. The motion was overruled. The electric light company was awarded the contract for lighting the city, and deposited with the city clerk a $50,000 certificate to secure the city against damages resulting from their failure to perform the contract.

Subsequently the company claimed to have discovered that the ordinance providing for the contract was not validly passed, and enjoined the city from negotiating the $50,000 certificate. The money was left tied up in the hands of the clerk, and the company charged that the city was irregular in the transaction of its business, the latter reporting that the company had used corrupt means to secure the indefinite judgment of the ordinance before the council so as to avoid the performance of that contract.

The decision of the court is a decided victory for the company.

Spanish Telegraph Strike Ended.

A cablegram from Madrid under date of June 24 stated that the strike of the telegraphers throughout Spain has been settled, and telegraphic communication with the provinces, which has been entirely suspended, is now restored. The action of the operators in leaving their keys created great confusion in government and business circles. The military operators were pressed into service to handle the wires in Madrid. The government promised to attend to the telegraphers' demands, and Senor Silva, the minister of the interior, has resigned to facilitate the settlement.

Perpetual Injunction Granted.

In the United States Circuit Court at Baltimore, Judge Morris has handed down decrees for perpetual injunctions in favor of the plaintiffs in four cases, two brought by the American Bell Telephone Company and two brought by the Western Electric Company, of Illinois, against the Viaduct Manufacturing Company, of Baltimore city, Augustus G. Davis, its president, and A. B. Davis, restraining the defendants from marking any words, such as "patented" and the like, on telephone call signal apparatus and other devices for which the plaintiffs hold patents, and from selling any apparatus prepared by the defendants which infringe the patents of the plaintiffs. The case is referred to a commissioner to ascertain the damages.

Rice Machinery Company.

The Oshkosh Electric Light and Power Company have just placed their order with the Rice Machinery Company, 63 and 65 South Canal street, Chicago, for the entire outfit of shafting, floor stands, friction clutch pulleys, etc., to be used in their new plant, now in process of construction at Oshkosh, Wis. This plant, when completed, will be one of the largest generating stations in the country and thoroughly representative in every way. The Rice Machinery Company are general western agents for the Dodge Manufacturing Company, of Mishawaka, Ind., and the appliances are to be of the latter company's manufacture. The Dodge patent split disk clutches and wood split pulleys will be used throughout. The main shafting is six inches in diameter and to be supported on the Dodge improved adjustable floor stands, and bearings to be of the late improved chain oiling pattern. The main receiving pulleys from the engines are the Dodge Manufacturing Company's celebrated wood split pulleys, and of sufficient capacity to transmit 500 horse-power each. It is our purpose, at an early date, to illustrate the Dodge split disk clutch, as many peculiar advantages are therein embodied. It is especially adapted to electrical generating work. The Rice Machinery Company, the contractors of the above mentioned plant, are making special efforts in the electrical field, and have installed some important plants, among them the Bessemer Electric Company, at Bessemer, Ala., 400 horse-power plant, and the plant at the Grant Locomotive Works, near Chicago, furnishing the motive power for their 80 ton electric cranes.

A Life and Efficiency Test of Incandescent Lamps.

READ AT THE GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, CHICAGO, ILL., JUNE 6, 1892, BY PROF. B. F. THOMAS AND MESSRS. P. MARTIN AND R. H. HASSLER.

Much has been written and said concerning the efficiency of the incandescent lamp and of the relation between its efficiency and the length of life to be expected from it. High efficiency lamps have their advocates and low efficiency lamps have theirs. It is pretty well understood by those whose work has put them in a position to appreciate the facts, that the question as to the choice of the lamps which will have best influence on the profit and loss account of the consumer depends on other things than first cost, efficiency and life. It is understood by such persons that the cost of producing the current supplying the lamps and the steadiness of voltage maintained on the lines are important factors in the choice, the high efficiency, short life lamp being best under condition of steady voltage and expensive current, and the low efficiency, long life lamp where current is cheap or regulation poor.

The general public, however, does not understand the question so clearly, and unfortunately that part of the literature of the subject which is found in the advertising columns of the electrical press does not tend to relieve the embarrassing ignorance of the buyer. Statements of the marvelous long life of certain lamps are followed in a week by ludicrous accounts of searches for them with a lantern and of the imminent peril of the country, arising from the exhaustion of our coal supply by the running of such lamps. Again we are startled by statements of the wonderful results attained by lamps of some certain make, as indicated by the number of such lamps which can be maintained at a full brilliancy by the expenditure of a horse-power. But immediately it is said that the insane asylums of the country are full of station managers and stockholders, whose cases have become hopeless through contemplation of the number of such lamps bought during the year. There is as great divergence between the published claims of lamp makers and the statements of the experience of station managers. Makers generally say that they will guarantee 600 hours life for their lamps, and from 10 to 14 or more lamps per horse-power, but some station managers insist that they do not get an average of 400 hours life.

Lamp makers have, from necessity, made a study of their own lamps, and of those of other makers also, as to efficiency and life, and they know better than any one else the character of the incandescent lamp of to-day. But naturally they, if they say anything on the subject, tell about the good points of their own goods and the bad points of others, and, as naturally, the buying public say that all their statements are questionable.

Much good work has been and is being done in college laboratories on lamp efficiencies, and the results are published and accepted, but on the equally important question of life the laboratories are silent. The tests of the Franklin Institute stand as a model piece of work, but that work is now eight years old. Farther, the lamps tested at that time were furnished by the makers themselves for the purpose of test. Believing that the public would be interested in the results of a test of commercial lamps, as to both efficiency and life, the writers have carried out such a test and give the results in this paper. The test was made at the Electrical Laboratory of the Ohio State University, Columbus, O., and all expenses incurred were paid by the trustees.

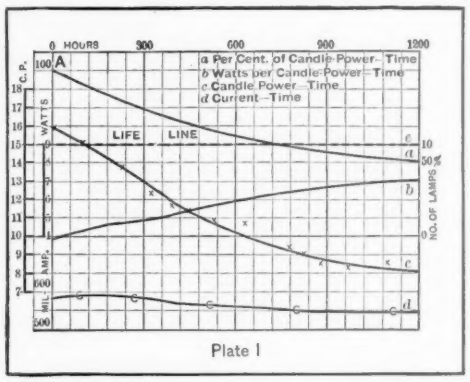


Plate I

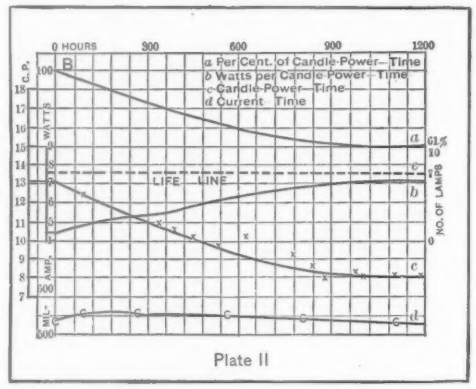


Plate II

Considering it of prime importance for our object that the lamps tested should be of the same character as those usually sold to consumers, we bought some lamps of regular dealers, as in the usual course of business, and obtained others from lots supplied for central station use. Lamps of the following makes were obtained, no attempt being made to get lamps of any given efficiency of any make: A. B. C., Beacon, Columbia, Economic, Packard, Pennsylvania, Standard, Thomson-Houston, Edison, Perkins, Sawyer-Man and Steuben. In ordering (through persons purchasing for us in Chicago and New York) we called for ten 110 volt lamps of 16 candle power in each case, but on receiving the lamps we found three lamps out of 10 of one make labeled 111 volts. The three were excluded and seven put in, but another lot of 10 of the same make, correctly labeled, was obtained. Ten of another make were received with the original marking, 111 volts in ink, changed by pencil to 110 volts. They were also excluded, and a new lot of 10 of that make, correctly labeled, obtained. Ten Sunbeam lamps were divided into two lots of five each, evidently supplied as a sample lot and were excluded. We could not get others of that make in time to enter the test. There were, therefore, in all 127 lamps, labeled 110 volts and 16 candle-power of 12 well known makes, 17 lamps in two separate lots of one make, and 10 each of 11 different makes.

For convenience in making the photometric measurements, the lamps were mounted vertically in horizontal rows of 20 on a light vertical rack, six feet high and 20 feet long. The rack was made in the form of ordinary shelving, having five vertical pieces of pine, four inches wide and one inch thick, and four horizontal strips of the same width, the four inch face being horizontal. The whole was rigidly braced diagonally, suspended by strong cords passing over pulleys in the ceiling and counterpoised by weights. This arrangement enabled us to bring each row of lamps to the level of the photometer described below, by raising or lowering the rack, and definiteness of position was secured by spiking to the brick wall of the photometer room two 2x4 inch vertical guides, against which the rack was pressed, and fastened each time by stout inclined pins, passed through the diagonal braces into holes bored in the guides.

A system of positive mains was arranged by fastening a No. 2 wire along the face of each horizontal strip in the rack, and joining them at the middle of the rack by a vertical No. 0 wire. A set of negative mains similarly made was placed on the opposite side of the rack. Flexible Okonite cable, of equivalent section, joined the No. 0 vertical wires to the ends of the dynamo mains fastened to the wall, which point is called the center of distribution. Porcelain keyless wall sockets were screwed in place on the horizontal rack strips, and joined to the mains on each side by No. 16 wire. All connections were well soldered.

A Thomson centiampere balance provided also with a resistance for obtaining standard potential readings was used as a standard for current and potentials. Its constants had been repeatedly checked by a voltmeter, and by Clark cells, and found correct and constant to within one part in 1,000. Two Weston milliampere meters and two Weston voltmeters were used in the current and potential readings on the lamps. The ammeters were graduated to 10 milliamperes, readable to one milliampere; and the voltmeters in volts, readable to tenths. The Weston instruments were compared with the Thomson balance at intervals, and found correct or affected by a small constant error, which was applied as a correction.

Current was supplied to the lamps by a 200 light Thomson-Houston dynamo of the spherical armature type, which proved to be an excellent machine for the purpose. Owing to the variable speed of the engine, due to varying load and steam pressure, a special automatic regulator was devised and applied to the dynamo to keep the potential at the center of distribution constant. This was effected by causing a small motor to slide a contact piece along two vertical German silver wires joined to an extension of the field coil of the dynamo, a current being sent through the motor in one direction or the other, as needed, by relay pins, the relays being controlled by an indicator attached to wires leading to the center of distribution. As used, the combination proved very satisfactory, keeping the potential difference at the center at 110 volts within a limit of three-fourths of a volt either way. It could readily have been set to a smaller margin, but that was not considered necessary.

For the candle-power measurements a two candle-power Methven screen was used, the gas being passed through a Methven carbureter containing pentame. Its constant was checked by standard candles. Three 32 candle-power Edison lamps were used as working standards. Each was checked at intervals by comparison with the Methven screen on a 100 inch photometer bar, a slide wire resistance enabling us to adjust the current through the lamp to a definite strength, which was always the same for a given lamp. The currents used were such as to develop about 18 candle-power in the standard lamp. Instead of the usual Bunsen or Leeson disk, we used a Lummer-Brodhun prism, made by Schmidt & Haensch. It gave us much better satisfaction than the best Leeson disks we have been able to obtain.

In front of the test rack and parallel with it was placed a bench with a guiding rail, along which a Weber portable photometer was arranged to slide, so as to be placed successively in front of each lamp in a row on the test rack. Instead of the little benzine standard lamp, which was removed, a sixteen-candle incandescent, called the reference lamp, was placed at a distance of about 300 centimetres from the end of the tube to which the benzine standard is attached. In taking the candle-power of the lamps under test, the photometer was first placed in front of one of the working standards. By means of a conveniently arranged slide wire resistance, the current through the standard lamp was accurately adjusted to the strength used with it, when its candle-power was measured on the standard photometer against the Methven screen. Care was taken that the adjustment of current was right when the measured potential at the terminals of the reference lamp was just 110 volts. Readings of the standard lamp against the reference lamp being taken the photometer was then moved in front of each lamp under test, and readings taken of each against the reference lamp. The candle-power of each lamp was then found by comparing these readings with those obtained opposite the standard lamp. The reference lamp being of the same character as those under test, and connected to the same mains, the slight changes in potential allowed by the regulator affected alike the candle-power of the reference lamp and the test lamp being read, allowing us to take readings more rapidly than we could have done had it been necessary to adjust and hold the potential at 110 volts.

Before the duration test began the mean horizontal candle-power of each lamp was determined in the usual way, and the ratio of this mean to the candle-power found when the plane of the ends of the filament was perpendicular to the photometer bar was found, and used as the distribution factor. The lamps were placed on the rack in the same position with respect to the Weber photometer, at a distance of about one metre from its plate, the exact distance of each lamp being measured and used in the calculations on it. All results are expressed in terms of mean horizontal candle-power. The unavoidable delays encountered in starting the test made it impossible to determine the spherical distribution without cutting short the time of run which we had set as desirable, viz., 1,200 hours. The

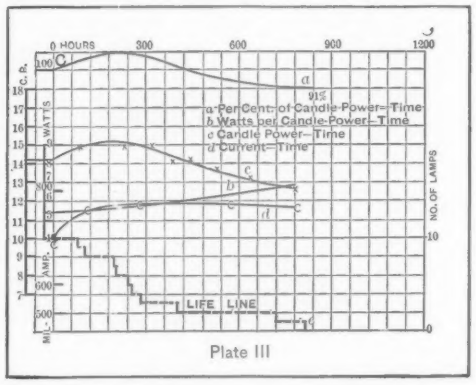


Plate III

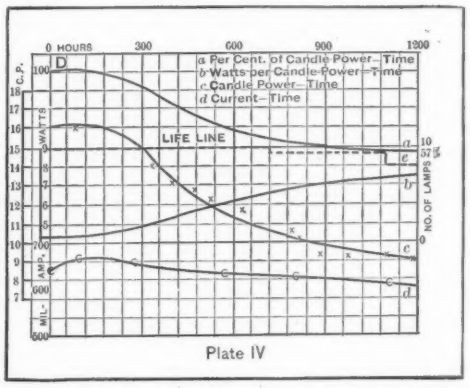


Plate IV

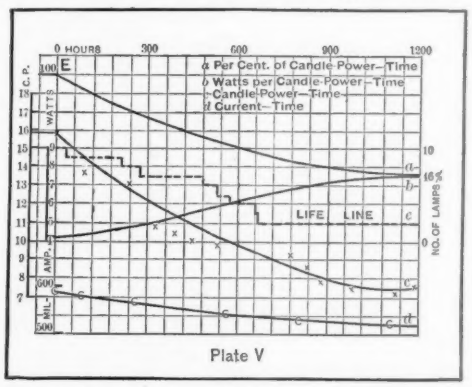


Plate V

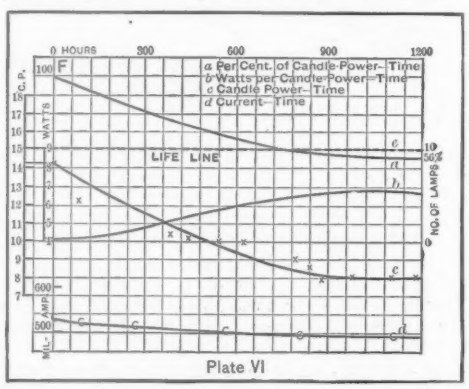


Plate VI

duration test was begun on March 17, and it was necessary to run night and day, Sundays excepted, until the night of May 14, to complete the 1,200 hours. The run began with 77 lamps on the rack. The remaining 50 lamps were received later and placed on the rack with the other 187 hours after the start.

As the methods used involve nothing particularly new, and have been fully described in print many times, we have considered it unnecessary to do more than state the general outlines, as above.

The object we had in view in undertaking the test was to determine the character of the incandescent lamp as a commercial product, not as a scientific instrument. The number of lamps of each make taken was, of course, too small to base a fair judgment on as to the absolute or relative merit of the lamps generally sold by the makers. For that purpose some hundreds of lamps of each make, taken from different lots, would have to be tested, which it was, of course, impossible for us to do. For this reason we have considered it unfair to the several makers concerned to give their names in connection with the results on their lamps, but have instead designated each make by a letter, and each lamp by a number. We believe, however, that the average of the results of all makes may be taken to represent fairly well the character of the average commercial lamp.

The results of the test are given in the following tables, the values given being, in each case, the average for a given make of lamp. Table I gives in the second column the average value of the distribution factors found for the 10 lamps of make "A," and the average value of the mean horizontal candle-powers for those lamps at intervals after the beginning of the duration test, expressed in hours by numbers in the first column. The third column gives corresponding values for the lamps of make "B," and so on. Table I includes the lamps started March 17. Table II contains similar data for the lamps started 187 hours later.

TABLE I.

Lamp.	A	B	C	D	E	F	G	K
Distribution factor.	1.05	1.07	1.01	1.11	.989	1.01	1.01	1.02
Hours from start.	C. P.	C. P.	C. P.	C. P.	C. P.	C. P.	C. P.	C. P.
0	16.0	13.1	14.1	16.1	15.9	14.2	17.1	17.0
93	15.0	12.4	14.8	16.1	13.7	12.1	15.9	16.1
233	13.65	12.4	14.9	16.0	13.1	12.9	16.4	16.5
324	12.2	11.0	14.8	13.9	10.9	10.8	14.5	13.9
392	11.7	10.5	14.0	13.2	10.5	10.4	13.6	13.4
441	11.3	10.2	14.2	12.7	10.1	10.2	13.3	13.1
537	10.9	9.9	13.6	12.3	9.9	10.0	13.0	13.0
637	10.7	10.1	13.0	11.9	9.5	10.1	12.4	12.4
785	9.4	9.2	12.6	10.5	9.1	9.1	11.4	10.9
833	9.1	8.6	All	10.1	8.5	8.5	10.9	10.3
883	8.6	8.2	out	9.3	7.7	8.0	10.4	9.8
972	8.6	8.3	...	9.2	7.6	8.0	10.4	10.0
1,105	8.6	8.2	...	9.2	7.4	8.0	10.3	9.5
1,190	8.2	8.0	...	9.0	7.5	8.0	10.4	9.6

TABLE II.

Lamp.	L.	M.	N.	O.	P.
Distribution factor.	1.10	1.00	.911	1.00	1.02
Hours from start.	C. P.	C. P.	C. P.	C. P.	C. P.
0	13.2	12.5	14.1	17.0	11.6
71	12.6	12.5	13.5	.....	.....
137	10.7	12.6	11.7	16.4	14.9
205	10.1	11.9	11.0	14.8	13.6
254	9.7	11.6	10.4	14.0	13.0
319	9.3	11.8	10.1	13.3	12.3
450	8.9	11.5	9.4	11.6	11.6
598	7.8	10.6	9.3	10.8	9.7
646	7.6	9.6	8.2	9.6	9.2
696	7.1	9.3	7.9	9.0	8.4
765	7.1	9.4	7.8	9.0	8.7
837	6.8	8.7	7.5	8.3	8.5
1,003	7.1	8.8	7.4	8.0	8.4

Table III gives the average current strength found for each make of lamp at times given in the first column:

TABLE III.

Lamp.	Mean current strength in amperes.									
	A	B	C	D	E	F	G	K	L	M	N	O	P
Hours.													
0	.567	.532	.693	.639	.589	.532	.662	.613	.458	.547	.608	.609	.536
100	...	...	...	...	...	...	...	...	.444	.532	.557	.665	.504
107	.575	.545	.760	.668	.561	.519	.689	.629	...	...	...	...	...
275	.567	.540	.778	.655	.566	.516	.651	...	...	...	...	...	...
380	...	...	...	...	...	...	...	...	.425	.518	.528	.615	.511
555	.543	.540	.770	.638	.541	.504	.662	...	...	...	...	...	...
615	...	...	...	...	...	...	...	.581	.418	.505	.519	.595	.495
790	.540	.535	.770	.619	.530	.498	.654	...	...	...	...	...	...
990	...	...	...	...	...	...	...	.577	.417	.500	.506	.585	.476
1,105	.535	.529	...	.611	.517	.495	.649	...	...	...	...	...	...

Table IV gives the mean percentage of original candle-power for each make at times given in the first column:

TABLE IV.

Lamp.	A	B	C	D	E	F	G	K	L	M	N	O	P
Hours.	%	%	%	%	%	%	%	%	%	%	%	%	%
0	100	100	100	100	100	100	100	100	100	100	100	100	100
100	93	94	106	101	92	93	95	93	87	100	87	95	107
200	86	89	109	94	84	86	90	87	78	100	79	87	90
300	79	83	106	93	77	81	86	83	72	94	72	80	86
400	69	73	102	82	72	77	81	78	67	90	67	72	78
500	64	70	98	75	66	70	77	74	63	86	63	66	71
600	61	67	94	70	61	66	73	70	59	80	60	65	68
700	61	64	91	68	57	62	70	67	55	73	56	55	64.7
800	56	64	90	63	53	59	66	63	54	73	54	51	62
900	55	62	All out	60	51	57	63	59	53	70	53	50	58
1,000	58	54	.....	58	49	56	62	56	54	70	53	49	57
1,100	52	61	.....	57	47	56	61	57	.....	.....	.....	.....	.....
1,200	51	61	.....	56	47	56	61	57	.....	.....	.....	.....	.....
Average.	100	100	100	100	100	100	100	100	100	100	100	100	100
	93	95.6	107	90	86	84.4	78.4	71	73	68.6	64.7	62	57.4
												57	56.6
													55.8
													55.4

Table V gives the average watts per mean horizontal candle-power for each make at times given in the first column:

TABLE V.

Lamp.	Watts per mean horizontal candle-power.												
	A	B	C	D	E	F	G	K	L	M	N	O	P
Hours.													
0	3.9	4.4	5.4	4.3	4.1	4.1	4.2	3.9	3.8	4.6	4.4	3.9	4.0
100	4.3	4.6	5.6	4.5	4.4	4.3	4.6	4.3	4.2	4.7	4.6	4.5	3.8
200	4.6	5.1	5.6	4.5	4.7	4.6	4.9	4.6	4.6	4.7	5.3	4.9	4.1
300	5.2	5.6	5.9	5.3	5.0	4.9	5.3	5.0	4.9	4.8	5.7	5.2	4.5
400	5.6	6.1	6.7	5.8	5.4	5.5	5.8	5.5	5.2	5.1	6.1	5.4	4.9
500	5.6	6.2	6.6	6.1	5.5	5.6	6.7	5.6	5.5	5.6	6.3	5.8	5.2
600	6.7	6.7	6.6	6.1	6.5	6.6	6.4	5.9	6.1	5.9	6.7	6.9	6.1
700	6.7	7.0	6.7	6.7	7.0	6.6	6.6	6.2	6.4	6.1	7.2	7.7	6.2
800	6.7	7.0	...	7.0	7.2	6.8	6.7	6.4	6.2	6.2	7.4	7.7	6.3
900	6.7	7.0	...	7.3	7.6	7.4	6.7	6.5	...	...	...	7.9	6.2
1,000	6.8	7.2	...	7.3	7.6	7.6	6.8	...	...	...	...	...	...
1,100	7.0	7.2	...	...	...	...	6.7	...	...	...	...	...	...
1,200	7.1	...	...	7.4	...	...	6.7	...	...	...	...	...	...
Av.	5.3	5.6	6.3	5.6	5.5	5.4	5.8	5.3	5.2	5.3	5.9	6.2	5.0
	4.2	4.5	4.6	4.6	4.5	4.6	4.6	4.6	4.5	4.6	4.5	4.6	4.3
												7.0	7.0

From the data given in the tables Plates I to XIII are constructed. Each plate refers to a single make of lamp. Plate I gives curves relating to the average lamp of make *A*. In it curve *a* gives percentage of initial candle-power, *b* give watts per candle-power, *c* gives candle-power, *d* gives current strength, and *e* gives number of lamps burning. The time scale is common to all the curves. The curves are lettered alike, are drawn to the same scale, and have the same starting points in each of the plates. The make of lamp referred to is indicated by the letter in the upper left hand corner of each plate. Curves *c*, *d* and *e* are plotted from observed values, but curves *a* and *b* are obtained from points 100 hours apart on *c* and *d*, combined, of course, with the voltage 110 for *b*.

Want of time, due to the pressure of other duties, prevented our taking readings as often as we would like to have done, and prevented also the examination of a number of points of interest which developed as the test progressed. For the same reason we are unable to include the data and curves for the individual lamps.

Thirty-one lamps in all were broken, distributed as follows: All of the C's (10), 2 D's, 8 E's, 2 K's, 4 L's, 1 M and 2 N's. All the lamps of A, B, F, G and O makes survived, the O's for 1,013 hours, the others for 1,200. The average life of the C's was 336 hours.

Plate XIV gives two sets of curves. One set gives the curve of general average of percentage of initial candle-power with respect to time, derived from the averages of the several makes, and beside it, the curve of the make which showed highest percentage throughout, marked minimum drop, make M, and also the curve showing lowest percentage, marked maximum drop, make L. The other set shows the general average of watts per candle-power, and also the curves of the two makes showing the maximum (make N) and minimum (make M).

Examining the results first for candle-power, we find the value 14.5 as the average of all the lamps tested at the time the current was first turned on them. Of the 13 separate lots, six only show an initial candle-power of 16 candles (neglecting tenths), though one make which started at below 15 rises above 16 within the first 100 hours. The lowest initial candle-power is found for make M. Makes G, K and O start at 17 candles, the highest figure reached at the start.

Looking at the curve which gives the average percentage of initial candle-power, Plate XIV we find that the lamps, on the average, grow dim at a steady rate, falling off to 90 per cent. in about 200 hours, to 68 per cent. in 600 hours, and end at 1,200 hours with a little less than 55 per cent. Deferring the consideration of the C lamps, the M lamps sustain their power best, losing only about 6 per cent. in the first 300 hours, and ending a little under 70 per cent. of their initial candle-power. The L lamps drop rapidly on the start, losing 30 per cent. in the first 300 hours and ending at 54 per cent. The E's and the O's drop to 47 per cent. at the close, but sustain themselves better than the L's in the earlier part of the run.

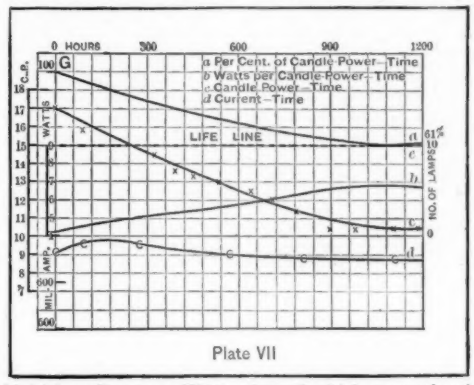


Plate VII

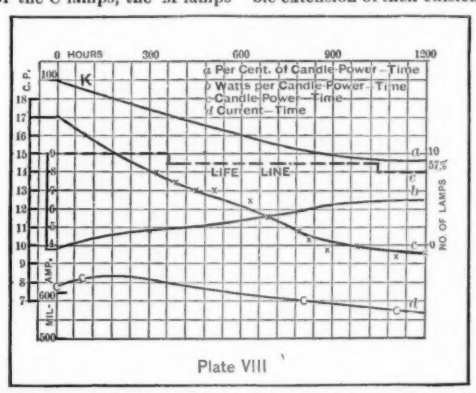


Plate VIII

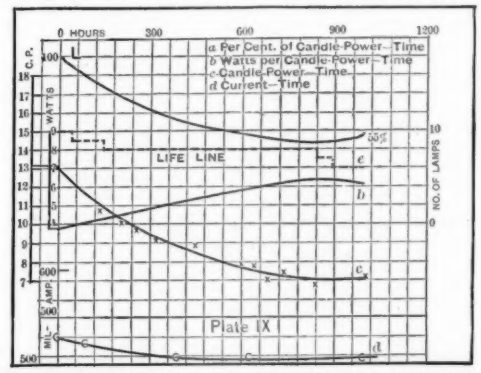


Plate IX

With respect to efficiency, using the term in its ordinary signification, as measured by watts per candle-power (though in this sense the reciprocal is the proper measure), Plate XIV shows an average initial value of 4.2, rising to 5.0 at 300 hours, 5.9 at 600 hours, 6.8 at 900 hours, and 7.0 at the end. The M lamps again have the best place, starting high but ending low, at six watts per candle-power.

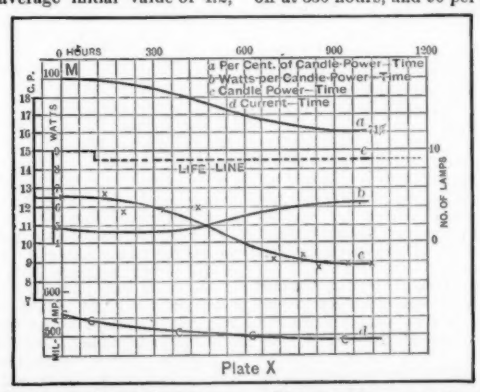


Plate X

But what shall we say of the results as bearing on the question of the life of the lamp? The answer depends on what we shall define the life of a lamp to be.

Is a lamp alive as long as current will go through it? Some advertisers seem to think so, and they seem to have support in their opinion, for some of their patrons have sent them, with complimentary remarks, lamps through which current is said to have passed for 6,000 hours or more. Adopting this view, our test shows 96 out of 127 lamps decidedly alive at the end of an average of 1,120 hours, and the leveling of the average curves of Plate XIV promises a considerable extension of their existence; 31 only have proven their mortality, and several of them lived to a good old age. The C's, poor things, all died young.

If we set the time of decease at the time when the lamp gives 50 per cent. of its initial candle-power, as some claim, the lamps tested have passed 1,000 hours on the average, and certain makes have passed 1,200. If life be defined still with reference to percentage of initial candle-power, but the limit be placed at 75 per cent., some individuals are still alive, but, on the average, all died at 450 hours; 80 per cent. as limit cuts them off at 330 hours, and 90 per cent. at 180.

But there is yet another way of defining the life of a lamp. The one who ultimately pays for the lamp is the one whose premises are lighted by it, and the thing he is supposed to pay for is light. For him the lamp is dead when it ceases to give a certain candle-power, without reference to what its

candle-power was when it was new. His premises, let us suppose, are properly lighted by a certain number of new lamps which actually give 16 candle-power. But when their light drops to 14 (12½ per cent.) he is no longer satisfied (and he ought not to be). For him the average lamp lasts about 240 hours. But if he is at liberty to choose the make of lamp, without reference to its efficiency, he will probably call for lamps of the G make, and get 400 hours service from them. If, however, he can induce the maker of the M lamp to make a lamp giving 16 candle-power when new, and having the same characteristics as those we tested, he will choose M's, and get 500 hours life. And that is the best that can be done for him, so far as this test shows. He would not have B's, L's or M's, as at present made, at all, because they do not give 14 candle-power when new, and if the station manager put in F's or N's he would order them out in less than a week. The state of things revealed by this test, as to the actual candle-power of new lamps, is certainly not what it ought to be.

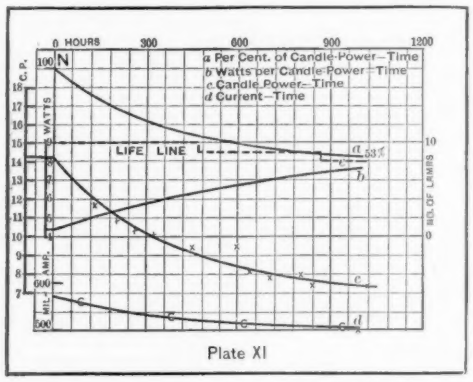


Plate XI

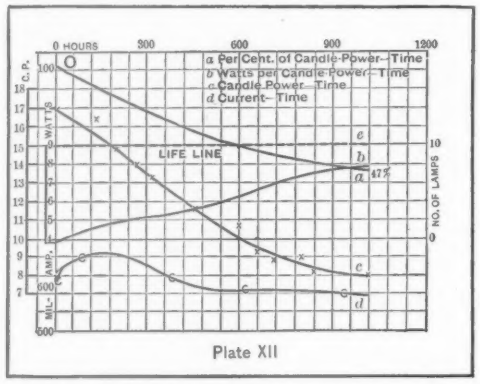


Plate XII

At the conclusion of the life test we dismounted all the lamps and placed them on a large table covered with clean drawing paper and uniformly lighted. The several lots were carefully examined with reference to blackening, the lot which was blackened the most being graded 100, and the other lots graded as closely as we could judge by comparison with the blackest lot and with one another. The grades are as follows: 10, 12½, 25, 28, 30, 32, 35, 42, 45, 50, 75 and 100 per cent. of the blackening of the blackest lot. When the sorting and grading was satisfactorily completed, and the letters on the lamp bases examined, it was remarked that *the two lots which were least blackened were of the makes which are advertised as exhausted by mechanical pumps.* That they should both be so much alike in blackening, and both only one-half as much blackened as the least blackened of the mercurially exhausted lamps is, to say the least, worthy of notice. It is, of course, not established that the observed freedom from blackening is due to the absence of mercury vapor in the lamps, as the makers claim, but if investigation should establish the claim the mercury pump will probably become once more a laboratory instrument. (The lot of lamps graded 10 per cent. and the lot graded 100 per cent. were mounted together on cardboard and exhibited.) As the giving of the letters designating the several lots of lamps, with the percentages of blackening, would, after the above statements, serve to identify the makers in the preceding tables and curves, the letters are omitted.

With regard to the performance of individual lamps of each lot, we found in some makes greater uniformity than in others, indicating either greater uniformity in manufacture or greater care in sorting the finished lamps on the part of some makers. The A lamps were among the best in this respect, and the C's and F's among the poorest. (Curves showing the individual performances of the lamps of the three lots named were here shown and discussed.)

So far as the lamps tested may be considered to fairly represent it, we draw from the test the following conclusions concerning the average 16 candle-power 110 volt incandescent lamp:

First—The mean horizontal candle-power of the lamp, as defined, is only 14.5 when new, instead of 16 as labeled.

Second—The candle-power of the lamp diminishes at a fairly uniform rate as it is burned, the rate of decrease being roughly 10 per cent. of the initial candle-power for each 200 hours burned.

Third—The lamp makers' claim that the lamp will burn for 600 hours before breaking is more than established, 96 out of 127 lamps being unbroken at the end of over 1,100 hours.

Fourth—Defining the life of a lamp to be the number of hours it will burn before it will fall from 16 candle-power to 14, we find the life of lamps in all respects like those tested, but so made as to give an initial candle-power of 16, is 240 hours.

Fifth—The initial efficiency of the lamp is 4.2 watts per candle-power. At 600 hours it is 5.9 watts and 1,200 hours 7 watts. The average efficiency during the first 600 hours is 5.04 watts.

Sixth—There is considerable difference in the rating of lamps by different makers, who nominally furnish the same article, the average initial candle-powers of the several lots ranging from 12.5 to 17.0. There is also considerable difference in the uniformity of the product of different makers.

The above conclusions properly complete this paper, so far as the purpose for which the test was undertaken is concerned. Some interesting points in the relative performances of different lamps may perhaps be alluded to in addition, since they cannot affect the makers.

Referring to Table V, lamps A, K, L and O have the same initial efficiency (3.9 watts per candle-power), and for the first 700 hours A and L keep together, rising to 6.1 watts. K does better, rising only to 5.6 watts per candle-power, while O rises to 6.9 watts.

Referring to Table IV, there is greater difference among the makes named, the K's at 700 hours giving 67 per cent. of their initial candle-power, while the A's give 61 per cent. and the L's and O's only 55 per cent. Of the four makes, therefore, the K's are best, since they maintain their candle-power better and have the highest average efficiency. The differences, however, are so small as to make noteworthy the similarity between lamps of the same class, coming from different factories, as in this case. Comparing the F's with the G's in the same table, the F's have a slight advantage in efficiency on the start, but they come together in 500 hours. The G's, however, have such an advantage in the way they hold up in brilliancy as to balance the slight difference in efficiency and make them the better lamp.

The most interesting result, however, arises from a comparison of the lamps L and M. The L's have the highest initial efficiency (3.8) and the M's the lowest (4.8), excluding, of course, the C's, which cannot be classed with good lamps, but after 250 hours burning the efficiencies are the same (4.75). At the start the L's are furnishing light at the least cost, but after 250 hours the M's have the advantage in this respect. If we suppose both makes to be used for 700 hours, the average efficiency is the same for both. But at this time the M's are giving 75 per cent. of their initial candle-power, while the L's are giving only 55 per cent. For the consumer the M lamp, then, is the better of the two, since the lighting of premises will be more uniform throughout the 700 hours of use supposed, and the cost of current for a given aggregate of candle-power hours is no greater than with the L's. If the time of use of the lamps be, say, 400 hours, the choice is not so evident, and will depend on whether the slight difference in cost (watt hours) is of greater or less importance than constancy of candle-power of the lamps.

A rough graphic comparison between the several makes of lamps may be made by considering the areas between the curves *c* and *a* of the several plates. The curve *a* is evidently parallel (raised three divisions) to the curve *c*, which would have been found if the initial candle-power of each lamp had been 16 as labeled, other things being unchanged. The more nearly horizontal *a* and *b* are, and the lower *b* is, the better the lamp. As drawn, the curves can only give qualitative results by such comparison, but if the scale to which the *b* curves are drawn were properly chosen, the area comparison might give more accurate conclusions as to the relative merit of the several makes. It is clear that the form of the area between the *a* and *b* curves in Plate X is nearer the ideal than any other, and that of Plate XI is poor. We are inclined to the belief that facts, such as those alluded to in the comparison of the lamps L and M, may lead to a modification of the views commonly expressed as to high and low efficiency lamps.

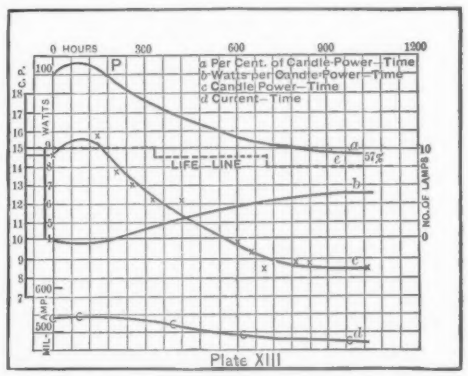


Plate XIII

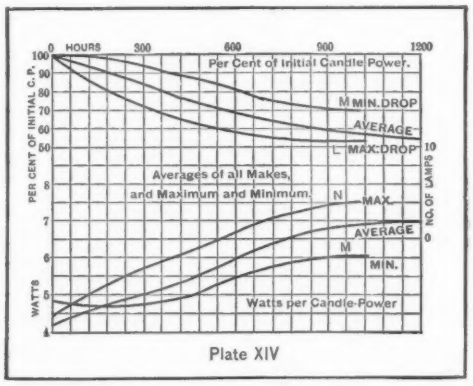


Plate XIV

LITERARY.

The president of the American Railway Association, Col. H. S. Haines, has written for the July number of the *North American Review*, an article on Railway Safety Appliances.

The Chicago *Inter-Ocean* issued a 32 page paper with an eight page colored supplement Sunday, June 26. The *Inter-Ocean* is the first paper in America to demonstrate the fact that four and eight colors can be thrown artistically on paper from the cylinders of a rapid running perfecting press. The fact that colored work can be done on a perfecting press shows its unique value in the illustration of current events.

Prof. Elihu Thomson contributes an entertaining, scientific and thoughtful paper on "Future Electrical Development" to the July *New England Magazine*. He explains the possibilities of electricity in all the public and private conveniences of life, and gives practical examples of its application to manufactures, rapid transit and domestic offices, such as cooking, ironing, heating, gardening, raising fruit and vegetables, etc.

The Digest of Electrical Patents is the title of a new monthly which will be issued August 9. It will be published by the Electrical Digest Publishing Company, 12 West Thirty-first street, New York, of which Ralph W. Pope, secretary of the American Institute of Electrical Engineers, is general manager. The subscription price is $5 per year to the United States and Canada and $7.50 per year to foreign countries. No advertisements or editorials will be included in the digest, which will be wholly devoted to illustrated synopses of all United States patents granted during the month on inventions relating to electricity, arranged in classes and sub-classes, with numerical and alphabetical indices appended. Such a publication should be of great value to everyone in the electrical industry, and especially to those who are required to be familiar with the state of the art as evidenced by the issuance of patents. The ELECTRICAL REVIEW wishes Mr. Pope and *The Digest of Electrical Patents* the fullest measure of success.

A Whale Killed by Electricity in the Year 1852.

BY A. M. TANNER IN LONDON "ELECTRICAL REVIEW."

It appears from a French patent, granted August 7, 1852, to Dr. Albert Sonnenberg, of Bremen, Germany, that the magneto-electric machine and accessories, forming the subject matter of said patent, had actually been used for killing a whale. This must indeed be considered a remarkable achievement at such an early date in the history of the magneto-electric machine, or more properly, the dynamo-electric machine, if we accept the generic definition of Professors Thomson and Houston that all machines for producing electric currents by mechanical force are dynamo-electric machines. It is not necessary to enter into details as to the construction of Dr. Sonnenberg's machine. It is sufficient to state that it consists of a crown or ring armed with a number of armature or induced coils turning before a number of permanent field magnets, with a current collecting ring and brushes, so arranged as to be capable of giving "a whale 720 galvanic shocks in one minute."

The accessories used in connection with the current generator are an ordinary harpoon carrying an electrical conducting wire, covered by the harpoon line and connected with one pole of the generator, so as to form one-half of the electric circuit, the other half being formed by the metal plated bottom of the boat containing the magneto machine and the sea water.

When the harpoon is lanced into the whale the circuit is completed, and as stated in the description, the "electric fluid passes through the body of the whale, and the latter receives at each rotation of the machine 12 heavy shocks, and as the machine can make one turn per second, the whale will receive 720 shocks per minute, of such a force as to stun or render the whale unconscious, as has been *proven by electrical experiment*."

It is a difficult matter to refute the Bremen doctor's underscored statement that he had actually been able to make a whale unconscious (*aneantit la baleine*, in French description) by electric shocks from his machine, and so the writer must believe the "whale story" with the mental reservation, however, that the whale must have been a little one. Bremen being so near the North Sea, it suggests the idea that the electrically killed whale of the Bremen doctor might have been the one of Olivette renown. The song here goes:

In the North Sea lived a whale,
Who bobbed up serenely from below,
etc., etc.

It is needless to say that when the Olivette whale learned of the fate of his mate he ceased "bobbing up serenely," and went to more congenial waters near the North Pole, where the "demon electricity" cannot follow him.

Anything for a Quiet Life.

Bilger rings up the telephone exchange.

Voice at the 'Phone—"What number do you want?"

Bilger (confidentially)—"No. 741."

Voice—"What number?"

Bilger (desperately)—"No. 741."

Voice—"Number?"

Bilger (wearily)—"Any one you like. Pick it out yourself."—*Chicago News.*

Cleaning Tin Plates by Electricity.

Dr. George H. Benjamin, the well known scientific expert and electrical engineer, of New York, has recently been granted a patent on a process in the art of making tin plates, whereby the dirt, grease and oxide of iron, commonly found on the plate blanks, are easily removed. The usual practice is to immerse the plates in a bath of sulphuric acid and water, allowing them to remain there a short time, and afterwards rubbing them with a cloth and sand to get rid of the impurities found on the plate. Mr. Benjamin's apparatus includes a tank containing the cleaning solution (a solution of sulphate of soda or sulphuric acid), provided with a positive electrode, preferably an iron plate, and a crate carrying the plates to be cleaned, which forms a negative electrode.

In Fig. 1 is shown an electric battery and

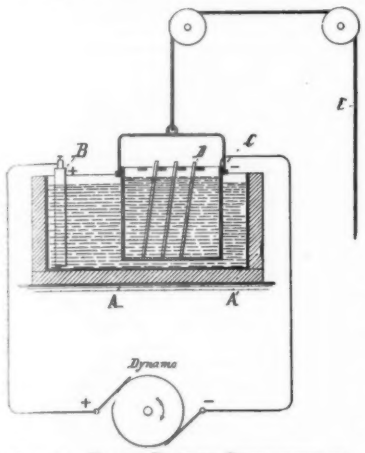


FIG. 1.—PLATE BLANKS CONNECTED TO DYNAMO.

the plate blanks immersed therein connected to the dynamo. Fig. 2 is a plan view of the battery. A is a battery cell, preferably of wood, having a rubber lining A^1. B is the positive electrode of the battery, preferably of iron. C is the crate formed into partitions for supporting the plate blanks D to be cleaned, which, as a whole, form the negative electrode of the battery. The crate C may be of conducting material or of insulating material, provided with suitably arranged conducting strips, it being entirely immaterial how the plate is constructed providing there are means for putting the plate blanks into the electric circuit. If desired, the crate may be dispensed with. E is a device by which the crate C may be readily raised from the battery cell.

The plates being placed into the battery cells A, the current from the dynamo is turned on. Oxygen is set free from the positive electrode B and hydrogen from the negative electrode (plate blanks) D. The

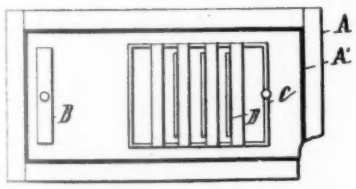


FIG. 2.—PLAN VIEW OF BATTERY.

hydrogen set free from the surface of the plate blanks reduces the oxides upon their surface and decomposes any grease that may be present, and incidentally causes any accumulation of dust or dirt that may be upon the blanks to drop off. Ordinarily, it is sufficient to charge the plate blanks in a solution of sulphuric acid and water containing the current from 15 minutes to three-quarters of an hour. If the plate blanks are very much covered with grease they may be immersed first in a solution of sulphate of soda, chloride of sodium, or any other solution of a neutral salt and charged for about 15 minutes, and subsequently introduced into a solution of sulphuric acid and charged as above described. After charging the plates are removed from the battery cell, rinsed with fresh water, and then dried by rapid heating, after which they are ready for the tinning bath.

Dr. Benjamin's invention has been tried with much success by several companies and promises to be one of those improvements in the art that every manufacturer will find it advantageous to use.

PERSONAL.

Lord Kelvin (Sir William Thomson), has been awarded the Helmholtz gold medal by the Berlin Academy of Sciences.

Dr. Louis Bell, recently editor of the *Electrical World*, has accepted a position as electrical engineer under Professor Rice at the Lynn works of the Thomson-Houston Company.

Mr. Joseph C. Nate, brother of Mr. J. J. Nate, of the Chicago Telephone Company, graduated from the Northwestern University Law School, Chicago, June 16. Mr. Nate is a capable and progressive young man and will make his mark in legal circles.

Ralph Sweetland, for three years employed in the marine department of the Thomson-Houston Electric Company at Lynn, was the successful competitor in the recent examination for master electrician at the Brooklyn Navy Yard. His percentage was 98.1.

The committee on science and the arts, of the Franklin Institute, at its meeting of June 1, adopted a report recommending the grant of the Elliott Cresson Medal to Lieut. Bradley A. Fiske, U. S. N., for his invention of an electrical range and position finder for naval and other service.

Mr. Charles A. Rolfe, of the Gamewell Fire Alarm Company, Chicago, was a New York visitor, last week, renewing old acquaintances in this city. Mr. Rolfe is in charge of a big department of this widely known company, and has been quite successful in his management of the business.

Mr. C. A. Ross, of Kansas City, Mo., the active representative in that section of the country of the Thomson-Houston Electric Company, was a recent visitor in the East. Mr. Ross possesses the energetic and enterprising characteristics of the Western man, and is meeting with much success in his work in the electrical field.

Mr. George W. Davenport, one of the several able workers connected with the Thomson-Houston Electric Company, and who has been in charge of the offices of the International Company of that name for some time past, will hereafter have his headquarters in the new offices at 44 Broad street, New York city, instead of at Boston.

Among the prominent electrical men visiting New York city last week was the able, persuasive and ever popular Mr. E. I. Garfield, for lo! these many years secretary of the Thomson-Houston Electric Company, and now secretary of the General Electric Company. Although one of the busiest of men, Mr. Garfield is always approachable, and no man in the electrical field has a larger circle of friends.

Mr. Chas. D. Shain, who has been for several years manager of the Eastern District of the Edison General Electric Company, tendered his resignation on July 1, to take effect in 60 days. Mr. Shain is prominently known in the electrical field as an engineer of ability and a business man of acumen. He is a valued member of the York Electric Club, holding positions on the board of managers and the house committee. Mr. Shain's many friends in this vicinity hope that whatever new labors he may take up will not cause his removal from New York.

"Ideal" Power Transmission.

A. L. Ide & Son, of Springfield, Ill., manufacturers of the well known Ide and Ideal engines, have recently devised a method of power transmission which they have named the "Ideal." The apparatus is extremely simple. It consists of a pulley supported by a stud which is secured to the base of the engine and requires no additional foundation or fixtures.

On account of the small space required, it is especially adapted for connecting engines and dynamos where space is limited. On account of the short belts required, the saving in the costs of belting is sufficient to pay the cost of the device.

Two dynamos may be driven from one engine by placing a pulley on each side of the engine base, and either machine may be stopped or started while the engine is running by sliding the dynamo on the base so as to bring the belt in contact with the lower surface of the engine pulley. Patents have been applied for covering the device.

One of these transmitters is installed in the plant of the Keeley Brewing Company, Chicago, and one in the station of the Springfield Electric Light and Power Company, Springfield, Ill., and they are working perfectly and satisfactorily.

New York Electrical Society.

The annual meeting of the New York Electrical Society, for the election of officers, reception of reports, etc., will be held on Thursday, July 14, 1892, at 7.45 P. M. sharp, at the Electric Club, 17 East Twenty-second street. The business will be taken up at the time named without a minute's delay by the members, in order that the second part of the evening's programme, which is open to all, may be carried out.

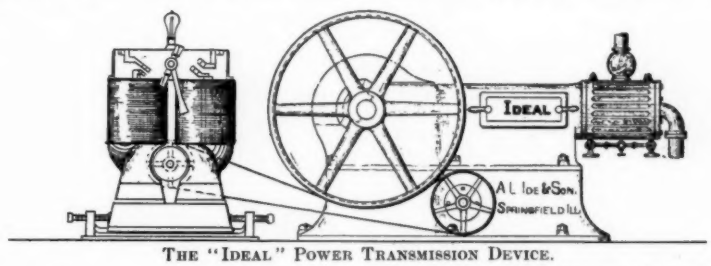
Special arrangements have been concluded with the management of the Madison Square Garden, through the kindness of Mr. David Henderson, whereby the members of the society will attend the performance of the successful extravaganza "Sinbad," in the Garden Theatre at 8.15 P. M.

This opera includes a large number of brilliant spectacular effects, utilizing the projection arc lamp in a way and to an extent never before attempted. After the performance members will be at liberty to ascend the tower and to enjoy the attractions of the Roof Garden, which include not only a fine concert, but some beautiful decorative uses of the electric light.

The invitation includes ladies as well as gentlemen, and it is hoped that there will be a large gathering of members and their friends.

Secret Telegraph Receiver.

The public has very little idea of the amount of "leakage" that goes on in the transmission of telegraph messages, says the New York *Commercial Advertiser*. An operator may be carelessly lounging in the vicinity of a way station or railway office with his hands in his coat pockets, one hand being busy in taking down with a short pencil on a pad information of the utmost importance which the noisy sounder is ticking off, and which may be used to the serious detriment of the interests of the sender. A stray visitor may be apparently simply looking over the tape at the stock quotations in a broker's office, but, in reality, he is concentrating his attention on the clicking of the sounder in the back room, which informs him what the firm is doing "on 'Change," or gives him other information not intended for "outsiders." With a view to gauge the extent to which such eavesdropping could be carried, an expert operator was employed a short time ago to call at some of the Wall street brokers' offices, as well as at some of the city hotels. Of some dozen offices he visited he was able in his way to obtain information more or less important from every one, and in the hotels it was found perfectly easy to take any and every message. By way of remedying this very serious drawback in certain classes of telegraphic work, a "secret" telegraph receiver has been devised. This instrument is fitted with a special resonator of aluminium of extreme sonorousness. Although the instruments, as generally constructed, may be kept so adjusted that no movement of the armatures can be detected with the naked eye, and that no sounds can be heard without holding the ear close to the instrument, this resonator, even under such conditions, transmits the message to a receiving tube from which the signals can be easily read. Besides this advantage of privacy, which the ability to read the signals on an exceedingly small movement of the armature gives, it is found that lines equipped with the new instruments can be operated with a very small amount of main battery, and can dispense with the sounder and local battery.



THE "IDEAL" POWER TRANSMISSION DEVICE.

Mercantile Telegraph Company Sued.

Attorney-General Hunt began *quo warranto* proceedings in the Circuit Court at Chicago last week to forfeit the charter of the Mercantile Telegraph Company, which was organized January 7, 1892. The corporation was organized as a stock company with a capital stock of $100,000 and the duration was fixed at 50 years. Instead of carrying out the object for which it was incorporated it is alleged that the company has been conducting a pool-room and gambling house at 267 and 269 Clark street for gain and profit to its stockholders with the knowledge and consent of the officers. Since the incorporation the company has allowed wagers on horse races and has collected a commission of one cent on each dollar received.

Incandescent Lamp Manufacture.

In about 18 months the Edison filament patent will run out and English manufacturers will be able to commence work again, says *Industries*. It must not be forgotten, however, that affairs will have a very different aspect then; it will not be competition with other makers of four-shilling lamps, but with foreign makers of fifteen penny "burners." These lamps are certainly cheap. We do not know if they are good, but they certainly seem to be so. It may be impossible for English makers to pick up lost ground, and to compete with foreign makers who have had some eight years' more experience. The great thing in incandescent lamps is to avoid the necessity of experimenting during manufacture. We would, therefore, urge intending manufacturers to set about perfecting their processes now so as to be quite ready when the time comes. It must be borne in mind that future makers are not entitled to prepare their factories and machinery beforehand, as this renders them liable for infringement of the patent. This is only fair. If the patentee has a monopoly of 14 years, and it takes one year to get his machinery ready, of course he has only 13 years of monopoly of manufacture if others can get their plant ready to commence manufacture immediately his patent lapses. This doctrine cannot refer to experiments, however, for the details of manufacture are all supposed to be worked out when the complete specification is filed.

Electric Fog Signaling.

"So far as appears from the present outlook, future telegraphic progress promises no great revolutions. Methods and means will, no doubt, become more and more refined, and greater speeds be attained," says Prof. Elihu Thomson in the July *New England Magazine*. "The more general introduction of multiplex systems will increase the capacity of the lines and decrease the costs, and more attention will be given to permanence of lines and to securing immunity from extended interruptions due to storms. It may be remarked here, however, that electricians are not without some hope that signaling or telegraphing for moderate distances without wires, and even through dense fog may be an accomplished fact soon. Had we the means of obtaining electric oscillations of several millions per second, or waves similar to light waves, but of vastly lower rate of vibration, it might be possible by suitable reflectors to cause them to be carried a mile or so through a fog, and to recognize their presence by instruments constructed for the purpose. Many of the difficulties and dangers which now beset the navigator would, at least, be lessened, if not removed. Signaling or telegraphing without wires is no new proposal, and there have been many such proposals which are extravagant and impracticable. The fact is, however, the essential means are not yet forthcoming.

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Advances made in electric transmission of energy have wonderfully developed the water-power resources of this country, and even to-day there are thousands of horse power going to waste until capital and electric science divert them.

Men engaged in the electrical business in this city seem to find it hard to get away for an extended vacation. The best that many of them can do is to run out of town over Saturday and Sunday. The majority cannot afford even this much time.

The Supreme Court has confirmed the report of the commissioners appointed by the court to pass upon the plans of the New York Rapid Transit Commission. The tunnel scheme is approved.

"We are of opinion," says the court, "upon an examination of the facts, that the success of the enterprise is not a question of engineering, but a matter of finance, and that the engineering problems can be overcome without any difficulty providing the money is behind the engineer."

Unless some of the property owners appeal, the next step of the Board of Rapid Transit Railroad Commissioners will be to endeavor to dispose of the franchises and organize a company or companies to build on the routes.

It was the dying Garfield whose mind in his unconscious moments returned to the struggles of his boyhood days and "babbled of green fields" with which, as a country boy, he had been familiar. The mind of Cyrus W. Field, as he suffers on his dying bed, goes back to those intense days of nearly two score years ago when his every thought and act were devoted to the union of two continents by means of the Atlantic cable. There is no greater deed chronicled in the history of this century than the successful laying of the Atlantic cable, and the unconscious utterances of Mr. Field at this time should call to life fresh appreciation of the great work of which he was the undisputed leader and cause a universal wave of sympathy for him in his hours of pain.

The manufacturing world is intensely interested in the contest waging between the Carnegie interests and the Amalgamated Association at Homestead, Pa. That bloodshed should have occurred is most regrettable. Whether the dissatisfied workingmen have adopted a proper course to attain their ends is a debatable question. Organized labor has rights, but none of these rights include that of breaking the law and defying the government. The Carnegie interests are very wealthy and powerful, and if it comes to a siege or a question of endurance, it is certain that capital will win in this instance.

WAS THE FIRST ATLANTIC CABLE INSURED?

An odd story relating to the first Atlantic cable was told recently to a gathering of electrical men by Mr. J. Rhinelander Dillon, of this city. He stated that the first Atlantic cable was insured for a large sum, and upon the failure of the cable to work a demand was made by the projectors of the cable upon the company for the amount of the insurance. This was refused, the insurance company taking the ground that they had insured the laying down of the cable and it had been placed, as could be proven by scores of witnesses, in the position agreed upon—the bottom of the Atlantic Ocean.

Mr. Dillon stated that this argument, as he learned, prevailed, and the projectors of the first cable never received a cent from the insurance company for the policy which they had been thoughtful enough to take out. This is an interesting incident of the pioneer work of this most audacious (at the time) scheme to connect the two continents.

Probably some of our readers can give us the details of the matter, which we shall be pleased to publish.

LETTERS FROM A LABORATORY.—III.

BY JULIAN A. MOSES.

A few words about the coloring of plaster.

It can be used in many places for filling up blow-holes, which are liable to show badly in a casting, or for cracks in the wooden bases of testing instruments. Bases themselves can be quickly and satisfactorily made from this material, and when deftly colored will defy close scrutiny.

Suppose we have a negative in plaster and we wish to make a positive; when we pour the plaster, the line of demarkation will be invisible, as the layers are of the same color. To obviate this the upper layer may be colored, thereby showing where it stops and the other begins. By inserting a knife between them, the layers may be separated.

The following are safe colors:

Blue—Charcoal or litmus.

Red—Venetian red.

Black—Nigrosine, or any aniline black.

Remember that the aniline dyes are very soluble in water; they can only be used when the casting is afterwards varnished.

It is often necessary to render plaster more durable to meet the requirements of the laboratory. There are several ways of accomplishing this desirable end, and the one I find best and easiest of manipulation is the following: After the plaster has set firmly you proceed to evaporate all the water. This can be easily done by placing the cast in an oven until you can feel that there can be no moisture within. Place the cast, thus dried, into a bath of melted paraffine or stearine, and leave it there until all bubbles of air have been expelled. This is easily seen when ebullition ceases. The cast will be found to have increased in weight from 30 to 40 per cent., and is always an advantage for the making of bases of galvanometers, voltmeters and other electrical instruments. Plaster is a boon to the experimenter, as it makes a more solid, though brittle, base than wood, and when thus prepared, with paraffine or stearine, is water and acid proof; and by simple rubbing with the hand a polish is produced that is very brilliant, though perishable, but which may be easily renewed by friction with a dry cloth.

Plaster in this condition may be satisfactorily turned on a lathe, and small patterns may be constructed of it, which would be very difficult to make from wood or metal.

Suppose, for instance, a machine to be in process of manufacture, it seems to me that a small model of each and every piece, when put together, would be of great value, were any of the original pieces lost or broken, as a reserve stereotype would be to any of the great daily papers.

If plaster during the casting of the model is submitted to too great a heat it loses its water of crystallization, to a certain extent disintegrates, thus spoiling whatever was in the mould, and sometimes even falling into pieces. The ill consequences inherent of this defect can be avoided by mixing something with the plaster that will overcome this effect of the heat. Substances that will do this must be incombustible, and must not form any chemical combination with the calcium sulphate, as shredded asbestos, powdered pumice stone, and powdered marble dust. Where great heats are required I would advise the use of the asbestos, as it will not only withstand the heat, but serves the purpose of holding the plaster together should it incline to fall apart. It will be better, where perfect results are desirable, to soak the asbestos in water for a few hours. To save time, a bottle containing the asbestos in water should be kept handy.

The proportions are, one ounce of the shredded asbestos to one quart of water. The mixture should be stirred before using, and substituted for water in mixing the plaster. Marble dust, unless ground very fine, will give a rather rough impression, so, for fine work, marble dust should not be used. Asbestos holds the plaster together; marble dust, while preventing disintegration, tends to weaken the plaster cast.

Suppose a case where we have broken a part of some instrument, of which it would be difficult to make a pattern in wood, and that the instrument is an astatic galvanometer and the part broken is the upright from which the needle is suspended. Suppose its shape to be such that it is easy to "draw" from the mould, we would proceed in this manner: Place the fractured pieces together so that, if the part be of brass, it will look unbroken. These should now be laid on a piece of glass or paper and the plaster and asbestos mixture poured on. If there be any undercuts, or if the pattern be at all rough, it would be advisable to soap it. This can be best done with a shaving brush, lathering the parts well, not forgetting to wash all the soap off afterwards, for, should any lumps of soap remain on the pattern, blow-holes will result. The pattern is now in the plaster, of which a generous supply must be used. When the plaster is "set" make a few furrows and one or two conical holes with the blade of a penknife. They should be on the body of the plaster and about one-eighth of an inch deep, for the plaster which fills them acts as dowell pins. Soap the plaster and pattern, which are on one plane, and run your second layer of plaster and asbestos (this time slightly colored to show the line of demarkation) over the whole surface, placing in close proximity to the pattern a greased lead pencil, or a piece of glass rod, to serve as a "sprue" or hole to allow the metal to be poured in. When this upper layer is thoroughly set the two masses should be separated. This can be done by inserting a knife blade between the distinct layers and gently prying them apart. It will now be seen that the scratches that were made serve to show the exact relative position of the layers. Corresponding to the furrows in the lower plate will be slight elevations in the upper one. The pattern should now be removed as easily as possible by means of a pen knife, and a little gutter cut from the "sprue" to the impression. Before casting the mould will have to be thoroughly dried in an oven, expelling all the moisture, which, if left in the plaster would generate steam, thereby spoiling the casting. It is true that this casting will be somewhat smaller than the original, but if we first dip our heated model into melted wax or paraffine, thereby coating it with a little film, this extra surface will, probably, be enough of an addition to allow for the shrinking of the casting after it has cooled. The result, if every precaution is taken, will be a casting that is smooth and without the annoying marks and fins of an ordinary casting in sand.

The following device may save many knife blades: Pierce two holes, about one inch apart, in the cork with a knitting needle, and through them push a cord, which should be tied securely, leaving enough slack above to enable you to get two or three fingers through so as to draw the cork. This, of course, does not apply only to the calcium chloride jars, but to any bottle in the laboratory that has a cork which may be hard to draw.

Dusting cloths should be continually on hand, and the kind I find best adapted for general use is made of a rough raw silk material resembling cotton bagging, though much softer, and has the great advantage of not leaving any lint which would be just as objectionable as the dust. These cloths should be kept in a clean drawer and not be allowed to come in contact with grease, oil or rags. They may, I believe, be purchased at almost any of the larger drug stores. I find them also excellent as wash and drying cloths, as the material is very absorbent and easily cleaned, and especially adapted for wiping and cleaning oil from commutators of dynamos and motors.

CORRESPONDENCE.

OUR CHICAGO LETTER.

J. G. **Brill,** Philadelphia, is in the city this week on business.

Wm. Sutton, president American Car Company, St. Louis, Mo., is again with friends in the city.

The **Railway Equipment Company** report that business still continues good, having received some very fine orders during the last week.

Wm. Hood has entered suit against the Perkins Electric Lamp Company, Knapp Electrical Works and Myron A. Knapp for $10,000 damages.

Meters for Arc Lamps are so very scarce that George Cutter finds a healthy market for his lamp-hour recorders. Many Western stations are already using them.

W. C. McKinlock, of the Enterprise Electric Company, returned Thursday from an extended trip throughout the West, and brings with him several large orders for electrical supplies.

The **Chicago Electrical Association,** at the close of its last meeting, adjourned until the second Tuesday in September. M. B. Speir was the speaker June 28th, his subject being "Notes on Pole Line Construction."

A Trial of Electrical and steam launches at Jackson Park is being made this week, which will practically decide as to the kind which will be adopted to run on the lagoons during the World's Columbian Exposition.

Payson K. Andrews, Western representative of the J. G. Brill Car Company, has left for a two weeks' visit throughout the East. J. R. Hanna will have charge of the Western office during Mr. Andrews' absence.

The **House of W. H. McKinlock,** of the Central Electric Company, was entered by a burglar on Thursday of last week, and several valuable art articles of jewelry were stolen. The burglar was afterward captured, but on the way to the station threw away the stolen articles. Search was afterward made for the same, but they were only successful in recovering a part of the stolen property.

The **Westinghouse Company** began active work Thursday on their contract for electricity at the World's Fair grounds by placing incandescent lights in the Woman's building. The construction department is setting the foundation for the iron arc light posts. Mr. Atwood has just completed his designs for these posts, which will be 18 feet high. There will be between 800 and 1,000 of them on the grounds.

The **Council Committee** on streets and alleys north met Wednesday to consider the ordinance granting the Chicago and North Shore Railway Company the right to extend its electric line south from Graceland avenue to Dewey Court, the cable terminus. Corporation Counsel Miller said that it was a question whether consent of property owners to a change from the cable to the electric system would have to be obtained. A substitute ordinance, providing that but one fare should be charged for a continuous ride inside of Graceland avenue was presented and the matter was opened to discussion. A large number of objectors were present and the meeting adjourned over until afternoon to give all a chance.

An **Ordinance Providing** for lighting the city by special assessment will be introduced in the council this week. The measure is the result of Superintendent Barrett's consideration of the subject. It will provide for the construction of plants, laying of wires and subways, and the erection of poles, the cost of the whole to be met by special assessment spread over the property benefited. The city now owns four plants, enough to light the district bounded by North avenue, Twenty-second street, Western avenue and the lake, but the appropriation is such that only 1,100 lights out of a capacity of 4,000 are used. Superintendent Barrett says that the construction of five more plants would equip the city with power enough to light all its streets. "The appropriations," said Mr. Barrett, "are so small that the department cannot meet the demands for electric light extension. If the lights were paid for by special assessment each district of the city could arrange for its own light and have plenty of it."

The **Capital Stock** of the Chicago Telephone Company is to be increased from $2,000,000 to $5,000,000. This new increase is for the purpose of extending the system in the business and outlying districts, to make adequate connection with the World's Fair grounds and buildings, and to complete the work of putting the company's wires underground, where the law requires them. This increase is not to be made in one lump. It was authorized last winter and is to be made in various issues of stock as the work of extension and improvement of the company's plant requires the money. One of these issues has just been decided upon, although no formal action has been taken by directors or stockholders. The proceeds of this new issue, the exact amount of which, according to a high officer of the company, has not been determined, will be used chiefly in completing the downtown underground system. It is also intended to go ahead now with the World's Fair connection, which must necessarily be an extensive branch of the company's plant and ready for operation very soon. Officers of the company are backward about stating the cost of this new plant more than that it will involve a great outlay of funds.

The Matters Pending relative to the awarding of contract for incandescent lighting at the World's Fair have finally been settled and operations for installing this plant will be begun at once. On Monday, Mr. Westinghouse appeared before the committee on grounds and buildings, and the result of the conference was that the Lawyers' Surety Company bond of $500,000 was guaranteed by an indemnity bond signed by August Belmont, Charles Francis Adams, Brayton Ives, Marcellus Hartley and George Westinghouse, Jr. This was accepted as satisfactory to the World's Fair directors. In accepting the contract for the incandescent lighting of the grounds and buildings of the World's Columbian Exposition, the Westinghouse Company promised the committee the finest and most complete electrical installation the world has ever seen. The Westinghouse Company have decided to use exclusively Grimshaw white core wire, cables, tapes and compound. Doubtless many of the buildings will also be tubed with vulca ducts, consequently the current for every incandescent light used in the grounds and buildings of the World's Columbian Exposition will go through Grimshaw white core wire, and many of the arc lights, motors, etc., will also get their current from this well known wire. Mr. E. E. Keller, the well known electrical engineer, has been appointed superintendent of construction by the Westinghouse Company, and it is safe to say that under his supervision the plant will be a most perfect and complete one. M. J. B.

Chicago, July 9.

OUR BOSTON LETTER.

Col. Louis W. Burnham, vice-president of the Electric Gas Lighting Company, has returned from a business trip to the Pacific slope, after an absence of six weeks.

Mather System.—The Rumford Falls, Maine, Paper Mill Company will have its mill lighted from this on by electricity. Apparatus for 180 incandescents and 16 arc lights has been contracted for with the Mather Electric Company.

Alexander J. Wurts, the inventor of the non-arcing metallic lightning arrester, of Pittsburgh, Pa., is here in New England introducing his appliance. Quite a number of stations have adopted it, among which is the Boston Electric Light Company of this city.

Mr. Albert E. Pond, son of Mr. A. C. Pond, president of the Simplex Electrical Company, returned home from Europe recently, after residing in Paris nearly two years. Mr. Pond was identified there with European Electric Welding Company. Many friends welcome him back.

The Shipman Engine Company, this city, has shipped one of its four horse-power oil engines to its agency, at Moscow, Russia, to be used at the approaching electrical exposition in that city. Mr. J. Schtscherbakow has taken the Russian agency for the Shipman Engine Company.

Damaged by Lightning.—During the recent great storm in this section, the electric light station of the Citizens' Gas Light Company, at Wakefield, was struck three times by lightning, causing considerable damage. Twelve transformers were destroyed and the armature of one of the generators burned out.

Mr. F. M. Ferrin, formerly connected with the Boston department of the Standard Electric Company, of Vermont, has established himself in business at room 22 Exchange Building, this city. Mr. Ferrin has taken the management of the National Air Purifying Company, which manufactures an electrical apparatus for the diffusion of perfumed air. The apparatus is a diminutive electric motor, connected with a fan and atomizer, which, when placed in an open window, or wherever there is a current of air, drives and diffuses the spray from a receptacle containing perfume.

Mr. C. A. White, president of the Eco-Magneto Clock Company, this city, returned home last Thursday, after an absence of four months on a successful business trip in the West. Mr. White sojourned six weeks in Chicago, and while in that city closed upward of thirty contracts for Eco-Magneto Watchmen Clock plants. Such inviting inducements were offered President White to locate a branch office in Chicago to cater to and promptly take care of the Western demand for the Eco-Magneto system, he at once established a branch agency at No. 116 La Salle street, in city named, under the management of Mr. A. H. Whiteside.

Boston, July 9. W. I. B

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week:

New Electric Railways.

STONE MOUNTAIN, GA.—A company is being organized and stock subscriptions are being taken for the purpose of constructing a street railway to connect this town, Clarkston and Atlanta. The road will be about 14 miles in length and will be operated by electricity.

OTTUMWA, IA.—W. Smith, of Ann Arbor, Mich., is interested in a company organized for the purpose of building an electric railway from Ottumwa to South Ottumwa.

CHELSEA, VT.—A company has been organized for the purpose of building a street railway to connect Chelsea and Royalton. Electricity will be adopted as the motive power.

CAMBRIDGE, MASS.—The Storage Battery Street Railway Company, capital stock, $50,000, has been organized, and will build an electric railway through sundry streets of this city. The road will be about three miles in length. Edwin H. Abbott, A. M. Howe and M. P. White, of Cambridge, and Abraham L. Richards, of Watertown, Mass., are interested.

LINCOLN, NEB.—A company is being organized and stock subscriptions are being taken for the purpose of building an electric railway to connect this city, Salton Lake and Cushman Park. The road will be about 12 miles in length, and will be constructed at an estimated cost of $50,000.

WARREN, OHIO.—The Trumball Electric Company has been incorporated with a capital stock of $150,000, and will construct an electric railway to connect Warren and Niles. H. C. Christy and A. B. Camp, of this city, are interested.

KIRKWOOD, MO.—A company is being organized and stock subscriptions are being taken for the purpose of constructing an electric railway to connect Kirkwood and St. Louis.

JEWETTVILLE, N. Y.—A company has been formed for the purpose of building an electric railway to connect Jewettville and Orchard Park. Sherman S. Jewett, of Buffalo, N. Y., is at the head of the project.

CHEBOYGAN, MICH.—The Cheboygan Falls Transit Company has been incorporated with a capital stock of $50,000, for the purpose of operating and maintaining a street railway here. Gerhardt Schneider, of this city, is interested and can give details.

MARSHALLTOWN, IA.—Jones & Hovey, of Independence, Ia., have been granted a franchise to build a street railway at this place. Electricity will be adopted as the motive power.

ELIZABETH, N. J.—The West End Railway Company has been organized with a capital stock of $75,000 for the purpose of building a railway through sundry streets of this city. The Citizens' Street Railway Company, capital stock, $50,000, has been incorporated, and will construct a street railway at this place. Applications for franchises for both of the above roads have been made to the City Council.

NEW ALBANY, IND.—Marcus Ruthonburg, of this city, has been granted a franchise to build an electric railway through the streets of Washington, Ind.

KANSAS CITY, KAN.—The Stock Yards and Northwestern Railroad Company is seeking for a franchise to build an electric railway through the streets of this city. The Common Council has been petitioned to grant a franchise for an electric railway to the E. L. Martin Company, Kansas City, Mo.

KALISPELL, MONT.—H. C. Sterling has been granted a franchise by the Common Council to erect poles and string wires for an electric light system.

DETROIT, MICH.—The Harris Electrical Propulsion Company; capital, $1,000,000. Incorporators, Edward Hartford, Nelson K. Riddle and Thomas Harris.

CHILLICOTHE, O.—The Chillicothe Electric Railway and Lighting Company; capital, $100,000. Promoters, William Poland, Clark W. Story, John A. Nipgen, Matthew Cahill, Richard Enderlin. Incorporation papers sent to L. T. Neal, Chillicothe, O.

PITTSBURGH, PA.—The Morningside and Highland Park Street Railway Company; capital, $25,000. Directors, Henry A. Davis, of Sewickley; Wilkins Linhart, of Allegheny, and N. P. Sawyer, of Pittsburgh.

New Electric Lighting Companies.

WEST NEWTON, PA.—W. H. Saam, of Irwin, Pa., is interested in a company organized to build a plant to light the streets of this borough with electricity.

NIAGARA FALLS, N. Y.—James Fay and Otis W. Dryer, of Rochester, N. Y., are preparing plans for a mammoth electric light and power plant to be built here for Leonard Henkle.

OTTAWA, KAN.—The Ottawa Water Works and Light Company; capital, $100,000. Incorporators, S. M. Jarvis, R. R. Conklin and S. L. Conklin, of Kansas City, Mo., and J. W. Pollock, of Ottawa, Kan.

JOPLIN, MO.—The Merchants' Electric Light and Motor Company has been incorporated, with a capital stock of $20,000, by J. E. Freeman, J. V. Pierce and O. F. Freeman.

MAZOMANIE, WIS.—A company has been organized for the purpose of erecting a plant to light the streets of Mazomanie with electricity.

Electric Heating.

PORTLAND, ME.—The New England Electric Heating Company; capital, $250,000. Incorporators, E. L. Jewell, of Boston, Mass., and A. B. Smith and L. L. Parsons, of Saugus, Mass.

New Wire and Cable Company.

SCHENECTADY, N. Y.—The United States Wire and Cable Company; capital, $1,000,000. Incorporators, Benj. E. Sunny, of Chicago, Ill.; Silas A. Barton, of Boston, Mass., and John Kreusi, of Schenectady, N. Y.

Underground Conduits.

WORCESTER, MASS.—The Common Council has appointed a committee to investigate and report on the advisability of constructing underground conduits for electric wires through the streets of this city.

Telephone Construction.

GRASS VALLEY, CAL.—Work will soon commence on a telephone line to connect Grass Valley and Nevada City. The Sunset Telephone and Telegraph Company is at the head of the enterprise and contemplates extending the line to Auburn, whence a line runs to Sacramento. Local exchanges will be established.

Electric Railway Motor Tests.

READ AT THE GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, CHICAGO, JUNE 6–8, BY PROFESSOR GEORGE D. SHEPARDSON AND EDWARD P. BURCH.

The experiments here discussed were undertaken for the purpose of obtaining definite information about the performance of electric railway motors under various conditions. There is a diversity of opinion about the relative merits of regulation by rheostat and by commutated fields, the use of one or two motors on a car, value of wetting rails, causes of "bucking" and other points. It is commonly understood that electric roads using rheostat regulation require larger capacity at the generating station than those using the commutated fields. It is also known that one large road has substituted rheostat regulation for commutated fields on all its motors. One large road has reduced the pressure on the lines to a figure considerably below 500 volts, with marked reduction in the repair bill.

Much has been said and written, but the data published are meagre and in some cases misleading. It was, therefore, thought desirable to obtain data from careful tests under working conditions, in the hope of substantiating some of the claims made, and of bringing out some new facts. The tests were conducted for the most part by Mr. Edward P. Burch, a senior in electrical engineering in the University of Minnesota, in connection with his graduating thesis, and by courtesy of the Minneapolis Street Railway Company, especially the master mechanic, Mr. William Cooper. Most of the tests were made upon a No. 6 Sprague double reduction motor of the type described by Mr. H. F. Parshall before the Institute May 21, 1890, and April 19, 1892. Some experiments were also made upon a single-reduction motor. Each machine is used at the repair shop for testing armatures, being anchored to a heavy crib sunk eight feet into the ground. Each car axle is replaced by a short shaft carrying a heavy cast iron wheel with solid web, upon which two oaken blocks are bolted for use as a brake. This was made into a Prony brake by removing the angle irons that held it to the floor and bolting on a plank to which an iron plate was fastened, so as to give a knife-edge bearing at a distance of 63.1 inches from the center of the shaft. This plate rested upon a knife-edge supported upon platform scales by which the turning moment could be measured. The mechanical horse-power delivered at the car wheel is

$$\text{H. P.} = \frac{2\pi R P N}{33{,}000} = \frac{P N}{1{,}000},$$

in which P is the pressure on the scales, N the revolutions of the car axle per minute. The speed was measured by a common speed indicator with soft rubber tip to prevent slipping. For slow speeds a stop-watch was used, the time for five revolutions of the car wheel being noted. Current and potential were measured by new Weston instruments about 12 feet distant from the motor.

The Sprague motor armature has 56 sections of eight turns each of No. 12 B. & S. G. wires. The speed is reduced 11,765. The field coil, as used at first, was in three sections, coil A of 700 turns, coil B of 820 turns, and coil C of 620 turns, all being No. 12 B. & S. G. wire. By means of the well known barrel switch, these coils are thrown into the following combinations:

Clip 2, coils A, B and C in series.

Clip 3, coils A and B in series.

Clip 4, coils A and B in parallel, C in series.

Clip 5, coils A and B in parallel.

Clip 7, coils A, B and C in parallel.

Several sets of efficiency tests were made with each combination. The three pairs of coils were then replaced by a sinple pair of coils connected in series and having several terminals, so that the number of turns used might be altered. This was used in connection with a Thomson-Houston rheostat. Efficiency tests were made with and without the rheostat. Only a few of the tests and curves obtained can be given in this paper. In comparing these curves among themselves and with the result of other experimenters, it should be noticed that the voltage was considerably below that for which the motors were designed, and that the power delivered was measured at the car axle. Different armatures were used on different days, and the curves in different plates are not strictly comparable; but the curves given in any one plate were taken with the same armature and with approximately the same voltage. Each of these armatures had been recently repaired, and although they had been well baked, there may have been some leakage through the green shellac. The foucault currents in the cores were probably greater than in new armatures. With the same armature and fields the efficiency is a few per cent. higher cold than when hot. It has been the aim to run as nearly as possible at the temperature of ordinary running, so that the fields were comfortably warm, but not hot. It is confidently believed that the efficiency of these machines would be considerably above 90 per cent. if taken at armature shaft and with full voltage.

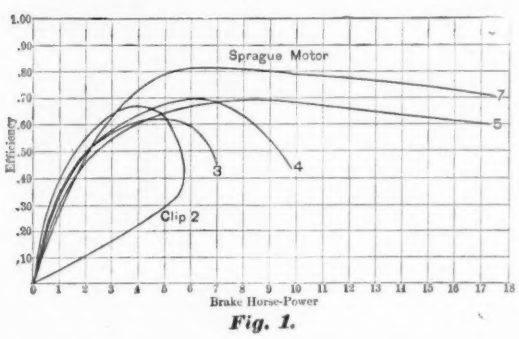


Fig. 1.

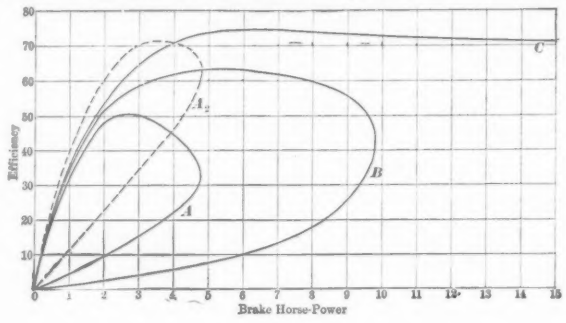


Fig. 2.

Fig. 1 shows efficiency curves for the motor with different combinations of the field coils.

In Fig. 3, curves A and B show efficiency of the machine with 857 and 611 turns of No. 7 wire in the field coils. It will be noted in Figs. 1 and 3 that the motor has highest efficiency with the larger number of turns on field coils until the iron is saturated, when the better efficiency is given with smaller number of turns and consequent lower resistance in field. This shows the advantage of working on the fifth and seventh clips with barrel regulator, or of cutting out part of the turns on field when the load is heavy. On starting the car the current is very heavy and the field is saturated with a small number of turns; hence the torque with a given current is nearly the same, whatever the windings of the field. The speed and counter electromotive force are small at starting; hence the potential difference at the armature brushes should be reduced until it passes only enough current to start the car without jerking. The easiest way of reducing the potential difference at the brushes is by interposing resistance; and the heat developed by the $C^2 R$ can be cared for more easily and cheaply in an open rheostat than in the field coils. Rheostats of iron and mica are cheaper and more heat-proof than cotton covered wires. This forces the conclusion that, for the heavy load due to accelerating the car at starting, the field should have the smaller number of turns, and as the car reaches normal speed, and the horse-power and C become less, the efficiency of the motor would be raised by increasing the number of turns in the field. This conclusion is exactly the reverse of the common practice of manufacturers who sacrifice some efficiency for speed at small horse-powers. It is also in line with the experience of the road mentioned, that replaced the commutated fields with a single series coil of No. 7 wire, and later with No. 5 wire. This heat-loss could be saved and the average efficiency raised by using the two motors in series at the start, and afterwards cutting out one or putting the two motors in parallel, if necessary, as the speed increases and horse-power decreases. An average of 12 tests on the road shows that with two motors on a car, it requires 27 per cent. less current if only one is working.

In Fig. 2, curve A shows the efficiency of

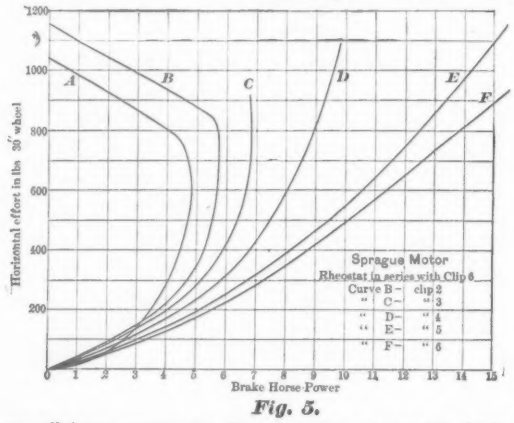


Fig. 5.

Sprague motor with single pair of coils, when the whole of a Thomson-Houston rheostat is in circuit. B shows about $\frac{3}{5}$ of the rheostat in use; and in C it is all out. The dotted line A^2 gives the efficiency as calculated from the difference of potential about the motor alone. Curve A_2 is not strictly comparable with the others, on account of the necessary variations in the voltage at the motor; but it does show the increased efficiency to be obtained by utilizing the superfluous voltage in a second motor in series. In this connection it is interesting to note that the resistance of rheostat as calculated from current and potential, difference, decreases with increase of current. This is as expected, since the larger part of the resistance is due to surface contact between the plates of iron in the rheostat, these being pressed together more closely as the iron heats. A similar effect, but much more marked, has been noticed in earlier experiments by one of us, with alternate plates of carbon and iron.

Figs. 4, 5 and 6 show curves of torque, speed and horse-power, referring to the No. 6 Sprague motor. In Fig. 5, A shows horse-power and horizontal effort on a 30-inch wheel; B, C, D, E and F, clips 2, 3, 4, 5 and 7, respectively. In Fig. 6, A shows speed and horse-power, with all of the rheostat in; E with $\frac{2}{3}$ of rheostat in; B, C, D, F and G, clips 2, 3, 4, 5 and 7, respectively. These may be compared with results presented by Prof. S. H. Short before the Chicago Electric Club, March 28, 1892. Fig. 7 gives curves of current, torque, speed and efficiency from a 15 horse-power Thomson-Houston single-reduction motor. The reduction ratio is 4.7857.

A large number of running tests were made on cars in regular service. Fig. 8 shows a run on the interurban line between Minneapolis and St. Paul. The distance is about ten miles, the schedule time 55 minutes, cars equipped with two 25 horse-power single-reduction motors. Special trains sometimes make this trip in 30 minutes or less. Fig. 9 shows three runs on the University line of Minneapolis on successive days, with the same car and same driver. The lower curve was taken when the rails were dry and dusty, middle curve with wet rails, and upper curve when the ground was covered with snow, eight inches deep on the level. The snow-plough had been over a part of the track about an hour before. The curves show variation of time, number of passengers being noted.

	Feb. 5.	Feb. 6.	Feb. 7.
Condition of track..	Dry.	Wet.	Snowy.
Number of stops....	38	50	36
Average voltage....	445	450	440
Average amperes...	15.15	14.9	17.5
Average amperes while working....	23.4	20.9	28.1

It will be noted that the current was less with wet rails, although there were more passengers. The load at the station is about the same for a rainy day as for dry, the difference being probably made up by the increased leakage on the lines, and by the larger number of passengers on some cars.

Fig. 9 shows variation of current on a single car. Fig. 10 shows variation of current on a feeder to line with five cars, the average current being about 60 amperes. Fig. 10 is plotted from readings taken at intervals of two seconds. The ammeter stops some little time at the high and low points, showing that these are actual values of the current and not due to the inertia of the ammeter.

Fig. 11 gives the results of readings one second apart taken on the main ammeters in Minneapolis and St. Paul, and on one feeder in Minneapolis. There were about 190 cars on the Minneapolis line, 100 on St. Paul lines, and 32 on the one feeder.

Fig. 12 gives the daily load of the Minneapolis power house, the curves being plotted from readings of the ammeters taken at ten-minute intervals throughout the day. In this case the power units are unusually large, there being two triple expansion condensing Corliss engines, the constant loss from friction in engines, shafting and dynamos averaging 218 horse-power. Indicator cards were taken simultaneously by means of electromagnetic attachments on each of the 12 indicators, the same current also giving signals to the observers at the ammeters.

A series of 13 tests were made for ascertaining the effect of wetting or greasing the rails on a curve. Two cars were coupled by a spring dynamometer and the pull noted while rounding the curve at ordinary speed, which was kept nearly uniform by means of a brake on motor car. The average pull on dynamometer is as follows:

	Dry.	Wet.	Greased.
Outer track.....	...500–800 lbs.	400 lbs.	300 lbs.
Inner track	650 "		400 "

The inner rail was wet or greased in each case; but on the inner track the greasing was not so thorough, on account of the lateness of the hour. It is noticed that wetting the rail reduces the power required about one-third, and greasing reduces it one-half. Readings of the ammeters on the car correspond in general with the dynamometer readings.

The "bucking" of street car motors is a subject of considerable interest to street railroad men, although it seems never to have been discussed in public. From the silence of the books and papers, and from the ideas current among railroad employés, the conclusion is reached that little is known about

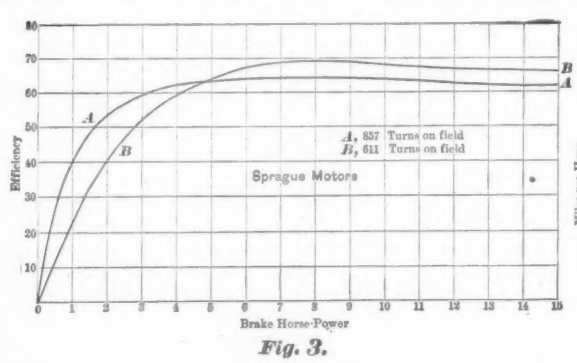


Fig. 3.

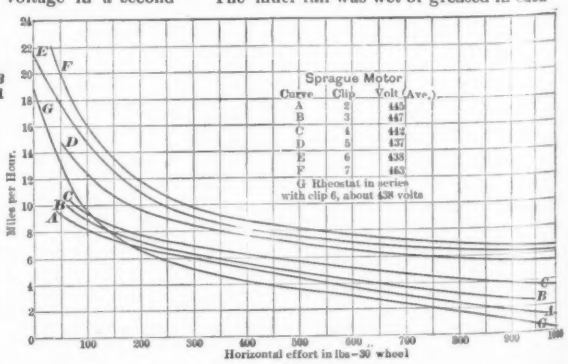


Fig. 4.

its conditions, causes or remedy. It is, therefore, thought wise to present the results of observation and tests, with a theory for the cause and remedy. It sometimes happens that an electric car suddenly stops as if by collision. In some cases the car refuses to go further, but usually it goes ahead immediately as if nothing had happened. This is known among railroad men as "bucking." To explain the action it is noted that in common practice the motor fields are connected

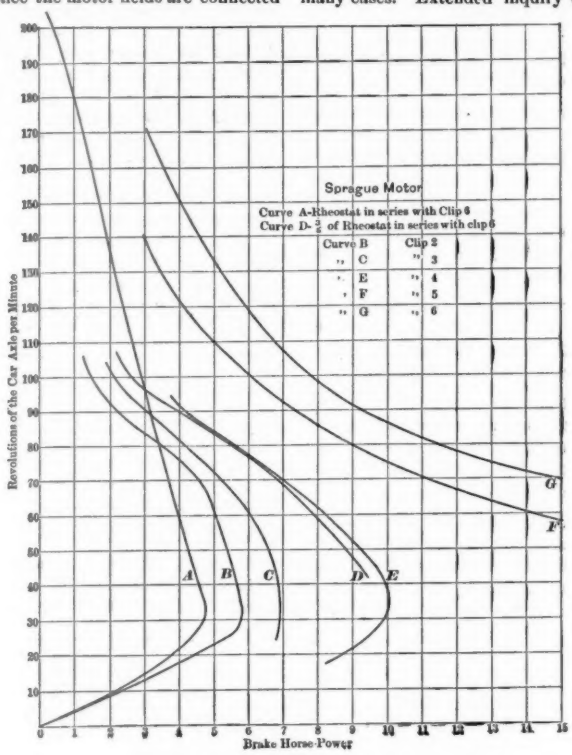


Fig. 6.

between the armature and trolley, the armature being grounded at the negative brush. If a second ground occurs on any part of the machine, except between the fields and trolley, a heavy current passes to ground, giving an intensely strong field, while the armature is short circuited by reason of the two ground connections. It, therefore, acts as a dynamo on short circuit, and becomes a powerful electric brake that stops the car very suddenly. This agrees with the facts, since a second ground either from loose connecting wires or broken insulation always causes bucking. Evidently if the ground occurs entirely outside of the machine no bucking follows, since the series motor cannot excite its own fields and act as a dynamo unless the armature connections are reversed. It is common practice to connect the two motors together between the fields and armature to equalize the work of the two machines. When a ground occurs in such a case, both armatures act as brakes, and the bucking is more violent than when the "equalizer" connection is not used. A loose reversing switch has been known to reverse the motors accidentally and spasmodically. There are many cases of bucking where no evidence of a second ground can be found. Doubtless some of these may be accounted for by temporary ground, which burns itself out, a common method of removing grounds and crosses. This explanation will not hold in many cases. Extended inquiry was, therefore, made among railroad men in order to gather as many facts as possible. Some of these reports were incredible at first, but seem to be honest testimony and were afterward corroborated by others.

It may be well to state that the term "bucking" is used with some looseness, being sometimes applied to cases where a motor acts badly for a variety of reasons, but as used in this article it is to be taken in the sense above noted. There is a tradition among the car drivers that a motor is very liable to buck if the current is full on while running down hill, but no case of this sort could be substantiated. Cases are reported of motor bucking when the circuit is open for an instant, as may be caused by the trolley jumping off and on or by the car passing over a dead rail or over a very dirty track. It is not plain that this is a true case of bucking, but rather of a sudden cessation and re-application of the propelling force.

Sometimes a car will buck at regular intervals. Examination of the motor shows a small bright spot on one brush which rolls to and fro at the contact between brush and commutator. This is intensely bright, like a ball of melted metal, and grows larger until nearly three-fourths of an inch in diameter, when it suddenly explodes with considerable noise and a blinding flash, and at the same instant the motor "bucks." The car goes on again at once, and the cycle is repeated again in the time required to run from one-half to four city blocks at ordinary speed. In such a case, the bucking is stopped by shifting the brushes.

One case is reported where a motor bucked hard although the brushes were removed so that the armature was entirely disconnected. Here the field was charged by being in parallel with the field of the other motor, and a cross in the armature coils short-circuited it. The foreman of the repair shop, where our efficiency tests were made, states that on six or eight occasions he has seen a motor buck because the carbons were not properly placed in the holders. In testing armatures rapidly the carbons are sometimes placed carelessly, so that the presser-foot rests partly on the carbon and partly on the holder. This presses the carbons against the commutator so as to give good contact until the carbon wears off a little, when the presser-foot no longer feeds it in. Vigorous flashing occurs, culminating in a buck, the shock of which may jar the presser-foot into its proper position, when the motor runs on as if nothing had happened, leaving behind no trace to indicate cause of trouble. Cases have been reported where a wire on the track touched the motor as it passed, thereby grounding it and causing it to buck. Similar grounding may be caused by water or mud being thrown upon certain parts of the motor.

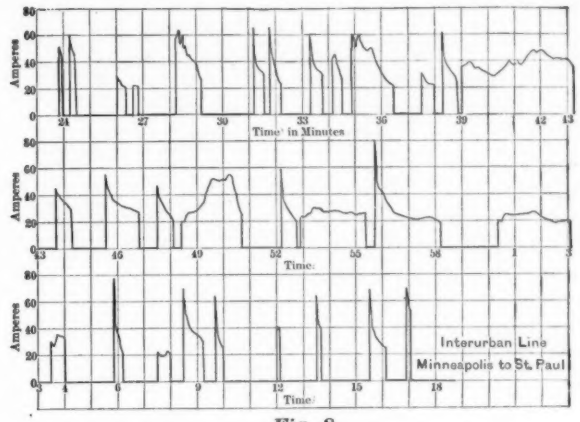


Fig. 8.

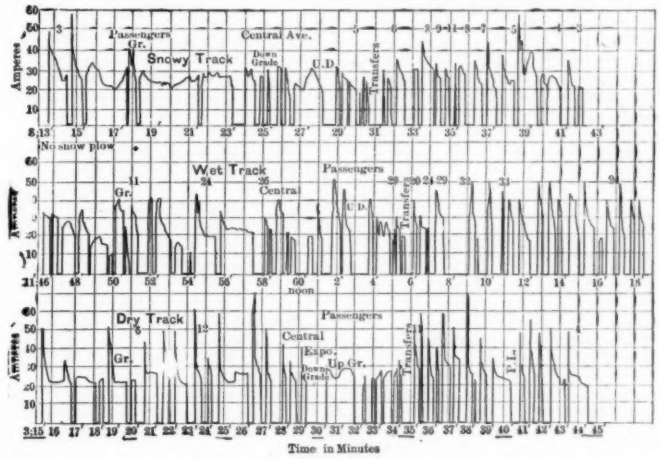


Fig. 9.

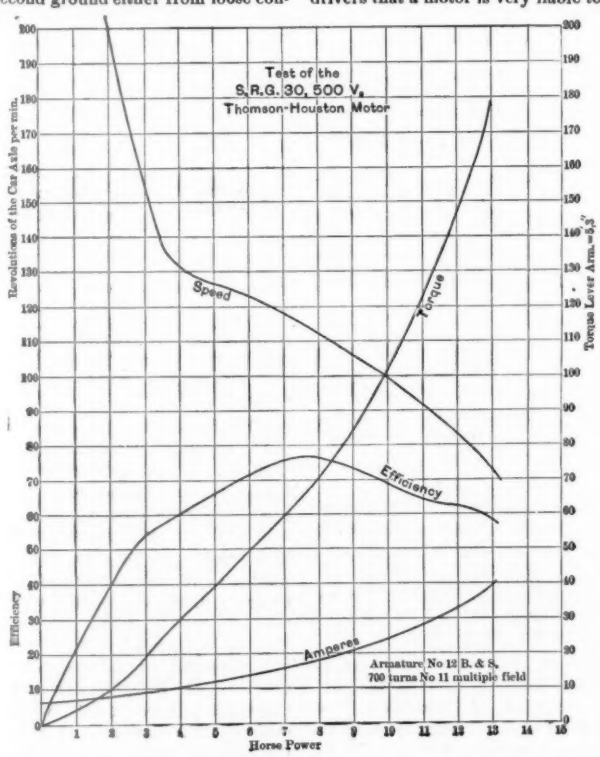


Fig. 7.

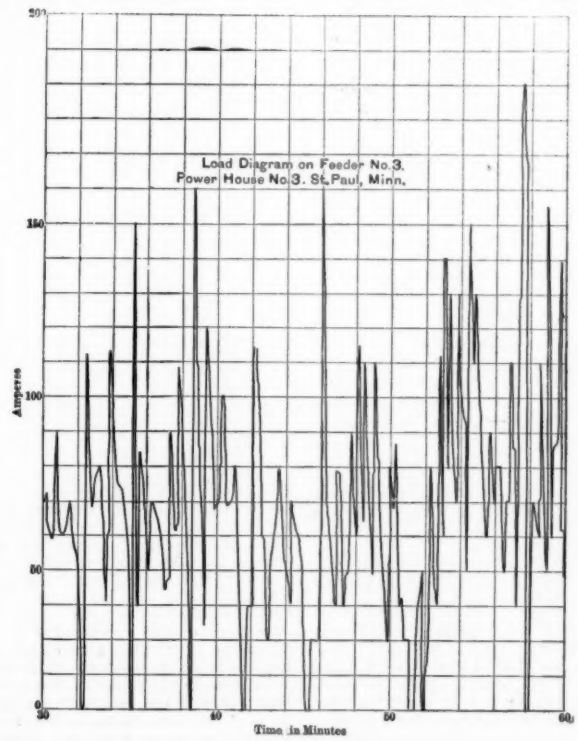


Fig. 10.

The motors with Gramme ring armatures are known to buck more frequently than those with drum armatures. These buck worse when run on the "loop," *i. e.*, with part of the field coils cut out, some of them bucking regularly every time the loop is cut

out. This is one reason why the use of the loop has been abandoned on this road, except in a few cases. The machines with commutated fields would buck when the field coils became old, although they showed no signs of being grounded. Bucking became much less frequent when the commutated fields were replaced by a single pair of series coils.

It was noticed that bucking was very commonly preceded by flashing at the brushes, although flashing was not always followed by bucking.

The explanations offered are various. One is that the iron in the fields varies in magnetic quality so that one motor works harder and by some means acts upon the other as a dynamo. Another is that one motor becomes reversed, while the other does not. Another is that bucking is caused by poor brushes or brush holders.

One explanation offered was that a partial

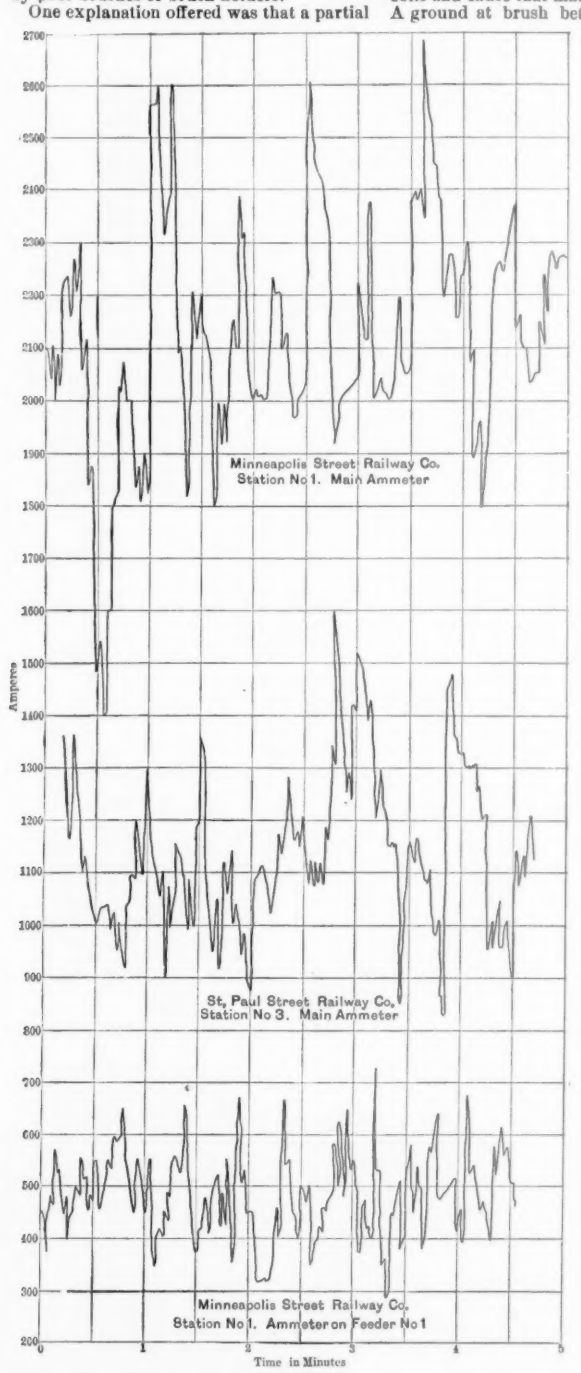

Minneapolis Street Railway Co.
Station No 1. Main Ammeter
St, Paul Street Railway Co.
Station No 3. Main Ammeter
Minneapolis Street Railway Co.
Station No 1. Ammeter on Feeder No 1
Amperes
Time in Minutes

Fig. 11.

break in the circuit, such as may be caused by shaking a loose connection, induces a high electromotive force that causes a flash to span the commutator.

In searching for a reasonable explanation for all these cases in which no second ground connection existed, it was noticed in each case that bucking was more liable to occur when the field was comparatively weak; also where the armature reaction was greater. In each case the neutral line is shifted and the coils under the brushes are in an active field. The large current in short-circuited coils further distorts the field, and the sparking at brush becomes excessive, causing a vigorous flashing. As soon as the counter electromotive force in the sections leaving the brushes rises above 20 volts, the arc is carried around from one brush to the other, thus grounding the positive brush and short-circuiting the armature, which then acts as a dynamo and causes the motor to buck. Such bucking is usually less vigorous than when caused by a dead ground, on account of the resistance of the arc. This explanation covers all the cases noted.

Such being the causes of bucking the remedies are plain. Armature reaction must be reduced. This militates against the conclusion drawn by Mr. Parshall, in his recent Institute paper, that the strength of field is of little importance, and that the windings of the armature should be a maximum. The liability to bucking would be reduced even when there is a large armature reaction, if the armature is divided into a large number of sections.

An obvious remedy for bucking caused by direct grounding would be to connect the fields between armature and ground instead of between armature and trolley. With such an arrangement, a ground on the fields would simply cut out a part of the coils and cause that machine to work harder. A ground at brush between armature and field would cause a sudden forward impulse on account of the field requiring some time to lose its magnetism, and would blow the fuse. A ground on armature would, likewise, cause a sudden forward impulse and blow the fuse. With such an arrangement there would be no true bucking, except in case of the flashing as noted. An incidental advantage of this arrangement is that the difference of potential between the field and the frame of the machine is reduced to a few volts, caused by the drop through the field; hence, there is less danger of grounding the field. The increased difference of potential between armature and core is only a few volts, and would not affect the insulation very much.

While H. J. Beany, a Long Island City telegraph lineman, was on a tall pole it snapped at the butt and fell. Beany slid down the pole while it was falling and escaped unscratched.

GENERAL NOTES.

A new telephone line between Paris and Bordeaux was opened June 8.

The International Bell Telephone Company has declared a dividend of five per cent., payable July 1.

A telephone line 210 miles long between Korat and Nong Khai, Siam, has recently been established.

Messrs. Stewart & Harper have taken over the Morden, Man., electric light plant and will operate it in future.

It is proposed to increase the capital of the Southern Massachusetts Telephone Company $50,000. Its present capital is $450,000.

Howell Cobb has contracted with D. A. Tompkins to light his new hotel at Hendersonville, N. C., and will use United States dynamos.

D. A. Tompkins and J. R. Gerden have purchased the gas and electric plants at Marshall, Texas, and will rehabilitate them, using Westinghouse apparatus.

The Mobile, Ala., Electric Light and Power Company have contracted with the Westinghouse Electric and Manufacturing Company for machinery for 3,000 electric lights capacity.

The Western Union Telegraph Company will, probably, next September, either increase its annual dividend from five to six per cent., or declare a stock dividend, increasing the capital stock to $100,000,000.

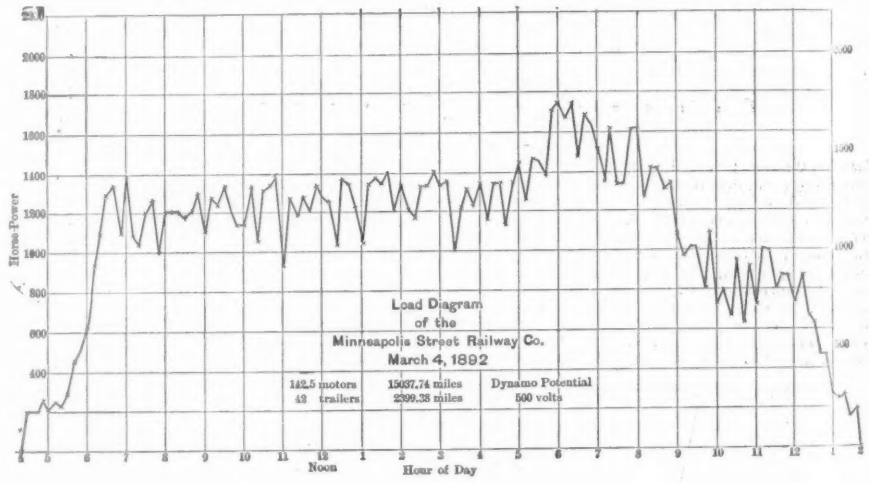


Fig. 12.

The gross earnings of the West End Street Railway Company, of Boston, for June were $600,000, an increase of about $50,000 over the corresponding period last year, and about $18,000 over August, 1891, in which occurred the Grand Army week.

Subscriptions to the new stock and bonds of the Edison Electric Illuminating Company, of New York, amounting to $1,600,000 cash, which closed June 21, were taken in full by stockholders, not a bond or share being left for the underwriting syndicate.

An increase from $2,260,000 to $5,000,000 of the capital stock of the Chicago Telephone Company has been authorized. The increase is to be used in extending the system in the business and outlying districts and in establishing the World's Fair exchange. The latter will be a big job and a costly one.

Judgment for $28,116 was entered June 21 against the Electrical Accumulator Company, formerly of 44 Broadway, New York, in favor of the Electrical Accumulator Lighting Company, of Detroit, Mich., balance due on an agreement made November 1, 1888, to purchase the plant of the latter company for $33,000. The former company has gone out of business.

The stockholders of the Harlem Bridge, Morrisania and Fordham, N. Y., Railway Company, the Melrose and West Morrisania Railroad Company, and the North Third Avenue and Fleetwood Park Railroad Company, met last week and decided to consolidate the three companies. The new organization will be known as the Union Railroad Company and will be operated under the trolley system.

The business of the United Electric Light Company, of Springfield, Mass., is still steadily on the increase, and this plant, which now supplies an aggregate of 2,900 horse-power, is shortly to be enlarged still further. They are now running from this station 7,000 incandescent and 750 arc lights, besides furnishing 800 horse-power to the street railway lines. Four engines, ranging from 200 to 900 horse-power each, are now doing the work, and a new 500 horse-power Armington & Sims engine is being installed.

The Mexican Telegraph Company reports these operations, partly estimated, for the quarter ending June 30, the figures being as of May 31, 1892:

Surplus above April dividend.....		$216,764
Receipts.....	$82,731	
Operating costs.....	17,500	
Balance.....	$65,231	
Dividend July 9.....	47,815	
		17,416
Surplus		$234,180

A dividend of 2½ per cent. for the quarter is declared payable July 9 to stock of July 2. President Scrymser says over 45 per cent. of this company's business is derived from connection with the Central and South American Telegraph Company.

The Bell Telephone Company reduced its instrument account 1,046 for the month ended June 20. There were 701 more instruments put out during the month as compared with 1891, but 1,747 more were returned. The comparative exhibit for the month and six months follows:

Month June 20.	1892.	1891.	Increase.
Shipments.....	8,912	8,211	701
Returned.....	4,414	2,667	1,747
Net output.....	4,498	5,544	*1,046
Since Dec. 20.	1891-92.	1890-91.	
Shipments.....	50,124	37,924	12,200
Returned.....	26,610	18,761	7,849
Net output.....	23,514	19,163	4,351
Instruments in use June 20.....	534,624	500,259	34,365

* Decrease.

The Citizens' Telephone and Electric Company, of Rat Portage, Ont., have received their charter and are now completing arrangements to erect their plant. Their motive power will be water wheels under a 17 foot head, and they propose at present putting in a 1,500 incandescent plant and a 50 arc light, and also a telephone exchange, the latter wire to be run on separate poles. The officers elected at their meeting last week resulted as follows: H. Gardner, president; H. Rideout, vice-president; A. Carmichael, treasurer; J. A. McCrossan, secretary and manager. It is most likely the National system that will be adopted, and it is the intention to have current turned on September 1.

World's Fair News.

The New York State Commissioners in charge of the first judicial district, comprising the city and county of New York, have opened World's Fair offices at Twenty-fifth street, Broadway and Fifth avenue, New York city.

A Large Electric Sign.

The beautiful exhibit at Madison Square Garden, during the recent Actors' Fund Fair, of the novel developments in electric lighting by means of new small lamps, formed the initiative and experimental effort, on a grand scale, of a new department of the Edison General Electric Company, the sign and decorative lamp department.

The adaptability of the electric incandescent light to ornamental sign work was considered as fully proved by the success encountered at the Actors' Fund Fair, and the president of the Long Island Railroad, Mr. Corbin, while viewing the many pretty effects obtained, decided to have a sign of his own, and commissioned the new department to realize his ideas.

On the corner block on Twenty-third street, formed by the confluence of Broadway and Fifth avenue, stands a small building, behind which rises a huge overtowering construction, nine stories high, exposing a plentiful surface of blank wall over the top of its dwarf neighbor. This surface, 60 feet wide by 68 feet high, has, for the past few evenings, been the synosure of the eyes of everybody coming down Broadway or Fifth avenue, or walking east or west along Twenty-third street. Upon the surface of this wall is erected, perhaps, the largest illuminated sign in the world, and certainly the largest and most conspicuous electrically illuminated sign. By means of this sign, Mr. Corbin brings, on these hot days, to the attention of a sweltering public the fact that the Coney Island of the well-to do Manhattan Beach is swept by ocean breezes, and emphasizes the various other special attractions to be found at that well known pleasure resort.

In this sign there are 107 letters, some six feet, some four feet and some three feet high, each of which is, in reality, a box of galvanized iron. In the interior of these boxes, arranged in the outline of the letters, are a number of small Edison porcelain series plug cut-outs, which are here used as lamp receptacles. At the lower end of each letter is a small sliding door giving access to a plug cut-out, which serves to protect the lamps in that letter. Each letter is suspended and clasped top and bottom to two iron rods formed of strong steam piping, which are securely attached to the wall by expansion bolts.

The illumination of the sign is obtained by the use of no less than 1,457 sixteen candle-power Edison lamps of different colors—white frosted, red, blue and green. The current is taken from the mains of the Edison Electric Illuminating Company. There are seven sentences, each of which is on a separate and distinct circuit controlled by a lever switch. The switches are arranged temporarily on a rough wooden frame, and as the primary object of the sign is to keep the different sentences constantly appearing and vanishing, the operator is in a state of constant agitation from dusk until 11 o'clock at night, when all the circuits are opened and the brilliancy extinguished. It is a strange fact, but true, that as long as the changes are being rung the public is attracted and stands agape watching the sign, but as soon as the whole seven sentences are lighted and allowed to remain so, the people move on their way and the crowd disperses. The number of possible changes on these seven sentences is 5,040.

From the switchboard, along the roof of the smaller building, the line is led to the base of the wall, whence the different wires shoot up into the air to their respective sentences.

At the end of each line is a small platform and between each line a long rod of bicycle steel, and each fastened securely to the wall, as are the letter supports, by expansion bolts. A flying ladder eight feet long, with small wheels, fits top and bottom to two of these rods and enables the attendant to run himself along each line and replace any broken or burnt out lamps or blown fuses, in a very few minutes.

As an additional protection to the wires outside, they are run through conduit tubes thoroughly taped at their junctures, and are carried up the wall on porcelain insulators.

The great difficulty with this sign, as in the case of all outside electric lighting work, lay in preventing the deleterious effects of rain and moisture. This has been overcome by fastening to the galvanized iron box leather covers, over each hole through which the lamps are thrust into the receptacles, small pent-houses of iron which project out over the lamps, and carry off the rain, without interfering in any way with the effect of the sign. Any rain which might collect on the lamp surface is prevented from running down into the receptacle by a small projecting brass ring fastened to the outside of the lamp near the screw shell.

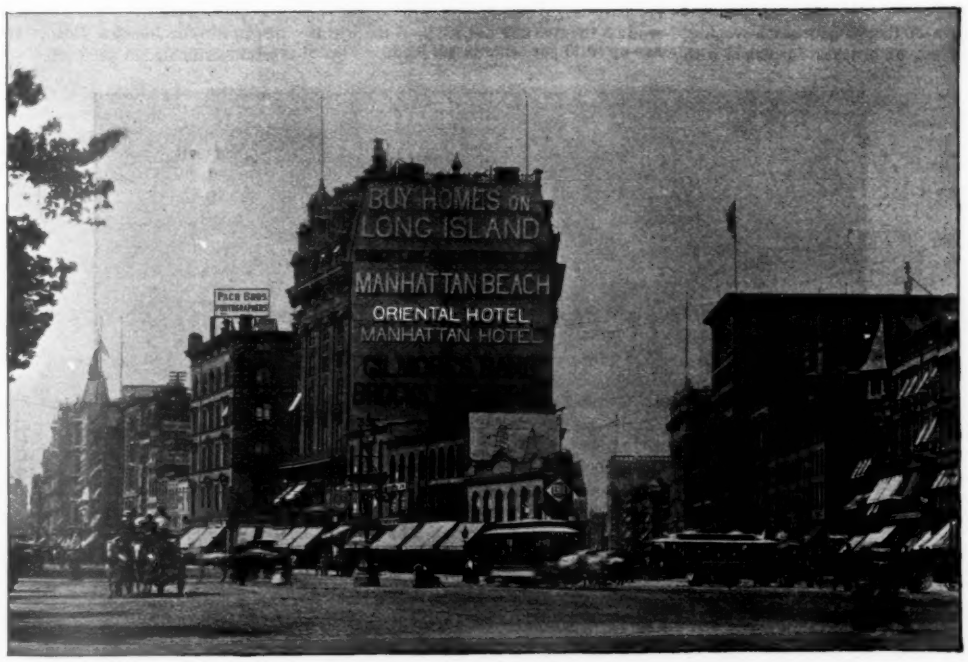
Each sentence is painted a different color, so that during the day the only thing lacking is the brilliancy of the illumination.

The entire work on this was completed in about 50 days. It was designed by, and constructed under the supervision of Mr. F. R. Upton, Mr. A. D. Page and Mr. McAllister, of the lamp works of the Edison General Electric Company, Mr. Corbin having practically given them *carte blanche*.

This illuminated sign is not only a commercial success, but when all the lamps are lighted is really a thing of glory. Its splendor is visible from far away up town, and its glow on the sky can easily be seen from the East and North rivers.

It is an immense step forward in the evolution of the electric light and its application to commercially advantageous uses.

A New Chandelier Switch.



A Large Electric Sign, Madison Square, New York City.

A New Chandelier Switch.

The new combination chandelier switch, manufactured by the Interior Conduit and Insulation Company, of New York, is an article which deserves special mention. The accompanying cut represents a chandelier made for four lights only, but as many lights as may be required can be controlled by this device, which embodies the same principles as are contained in the Greenfield pull down switches, also manufactured by the Interior Conduit and Insulation Company and recently described and illustrated in these columns. The mechanical arrangements of this new switch are most ingenious, and are contained in the shell or body of the chandelier. A pull on the cord turns on or off, at will, one or more lights consecutively, thus dispensing with switches on the side wall or key sockets in the chandelier. No extra wiring for the switch and chandelier is required. Each light is under direct control by simply pulling the cord, and the switch can be incorporated in the body of any chandelier as it merely intersects the stem of the same. This ingenious and extremely useful article has instantly and favorably commended itself to the attention of the trade.

And Now Let the Courts Decide.

To the Editor of Electrical Review:

While the International Ore Separating Company does not desire to carry on, through your columns, any dispute with the Magnetic Separator Company, having had recourse to other effectual means, yet we must reply to the latest statement of that company, which infers that its service of suit had been evaded by the International Ore Separating Company. We wish to state, distinctly and fully, that no service, nor attempted service of suit by any officer of the court or other person, was made upon the International Ore Separating Company until after the denial of suit published by this company and its expressed readiness to prove its claims before any court, as given under date of June 18. The publication of this denial, as intended, compelled the Magnetic Separator Company to make good its original statement, or cease from its attacks. As previously stated, this company is prepared to protect its patents and to establish the illegality of the claims of the Magnetic Separator Company, and will do so as rapidly as the matter can be pushed.

Meanwhile, the International Ore Separating Company will continue to do business "at the old stand," and will guarantee full protection to all its customers in their use of its machines or patent rights.

Very respectfully,
International Ore Separating Co.,
Harvey S. Chase, Treasurer.
No. 1 Broadway, New York,
July 2, 1892.

An Operator's Clever Ruse.

The crowds about the telegraph offices awaiting news from the Republican Convention of 1880 were just wild for news; they hungered and thirsted for information from Chicago, and it seemed as if it never would come. They besieged the office and bored the people in charge, and were not satisfied until they got something. Finally, an operator, whose bump of pity is as large as his bump of humor, bethought himself of a plan to appease the news-hungry gang.

He manufactured some convention news of a harmless character, but it was what was wanted. Every little while the operator would struggle through the frantic crowd and post a bulletin. His first read like this: "Mr. Conkling has arrived at the convention door. Cheers." That was something, anyhow. Then he posted this one: "Mr. Conkling has entered the convention. Great enthusiasm." This was met with much favor. Then he put up: "Mr. Conkling is walking down the main aisle. Wild cheering." The crowd joined in the imaginary cheering at Chicago. Finally, he put on the bulletin board: "Mr. Conkling takes his seat. Tumultuous applause."

This set the crowd wild. And then that operator would vary his bogus dispatches with descriptions of how Mr. Cameron entered the convention and his reception; the cheers that greeted Garfield; the enthusiasm over Logan, until he had exhausted his stock of eminent men. By that time the real work of the convention had begun and genuine dispatches began to come over the wire. It was a safe and harmless ruse, but it kept the crowd in a good humor and the masses thought they were getting the news, and if they didn't know anything to the contrary it didn't hurt them. Years after the operator told of his little scheme, but he only played it once to win.—*Harrisburgh Telegraph.*

A dividend of two per cent. on the common stock of the General Electric Company has been declared payable August 1, 1892. Transfer books close July 20 and re-open August 2.

New Dynamo of the Detroit Electrical Works, Detroit, Mich.

The illustrations accompanying this article will give our readers a good idea of this dynamo, as they include plan, side elevation, pulley end elevation, commutator end elevation and perspective view.

The type illustrated is that which has been adopted by the Detroit Electrical Works for all sizes up to and including the 30 kilowatt, being, as will be seen by the illustrations, a two pole machine, in which the frame and bed-plate consist of one solid casting. Above the 30 kilowatt the type will be similar to that illustrated, except that the machines will be multipolar. The journal boxes are provided with self-centering and self-oiling sleeves, which insure perfect alignment and lubrication.

Each bearing is provided with a gauge glass which shows the height of oil in oil chamber, and with a cock by means of which the oil can be drawn off whenever desired. The lubrication of each of these bearings is accomplished by the use of two rings which revolve and carry oil to the top of shaft, from which it is distributed by means of oil grooves in the self-centering sleeve. Directly over each of these rings, in the outer shell of bearing, is a brass plug, which can be lifted out when it is desired to ascertain if the rings are working properly, or to put in new oil.

The rocker arm which supports the brush holders is mounted directly on the self-centering sleeve, thus insuring the brush holders being kept central with regard to the commutator.

Carbon brushes are used on all sizes of machines, both for motors and generators. The brush holders are of a new type, covered by patents held by the Detroit Works, which provide just the tension requisite to make good contact of brushes with commutator without more tension than is required, consequently avoiding heating of commutator by unnecessary friction. This tension is obtained by the use of a spring coiled in the form of an involute, the outer end of which is continued straight from the side of the coil—which is below the brush holder—up to and a little above the outer ends of the carbon brushes. The idea being to have the tension due to coil when straight end is in a perpendicular position just sufficient to insure the proper contact. Then, as the coil of the spring is mounted upon an adjustable axis, which can be moved in or out at will, as the commutator brushes wear, the spring can be moved inward, always maintaining the straight end of same in a perpendicular position, thus insuring at all times the same tension of brush upon the commutator without changing the adjustment of the spring itself in any way whatever.

This adjustment can be made at any time, very easily, by a single movement. As the carbon brushes feed radially they, consequently, wear squarely across their entire thickness, and never require trimming.

The two features of the lightest tension possible of the commutator brushes on commutator, and the use of the carbon brush, will serve to greatly lengthen the life of the commutator, and not only by reducing the wear, but also by reducing the possibility of damage to either brush or commutator by sparking, if the machine is overloaded, such as would naturally result from the use of copper brushes. This means a great saving in the matter of repairs, as the commutator is an expensive part of a dynamo. The expense of brushes is also much reduced, as carbon brushes not only cost much less than copper, but wear many times longer.

In this connection we desire to call attention to the record made by machine furnished by the Detroit Electrical Works to the Posselius Brothers Furniture Company, of Detroit, which machine, although one of the old type, was fitted with their improved brush holders and carbon commutator brushes. After 16 months' use every working day, of which time the machine was running for a number of hours each evening, the original set of brushes furnished with the machine were still in use and not one-third worn out, while the commutator itself, although glazed by long use, showed no actual signs of wear when straight edge was applied to same.

The armatures of all machines up to and including 30 kilowatt are of the Dru type, but a special winding is used which is covered by patents held by the Detroit Works, which not only economizes space at the ends of armature core and holds the wires at ends in position firmly so they cannot chafe, but also has as its most important feature the advantage of having no two wires adjacent to each other that have between them any great differences of potential, thus doing away almost entirely with the probability of burn-outs. This winding also gives the largest opportunity for ventilation, and makes the danger of crosses at the ends of armatures as small as possible. The method of insulating the armature cores and wires is the very best known, consequently these armatures are not liable to burn out under any circumstances.

The commutators of these armatures are of a new design, and are the finest commutators that have ever been manufactured; mica is the sole insulating material used throughout them.

The field coils are wound on metal spools and then slipped into place on the pole pieces, where they are almost entirely covered and protected by the iron frame of the machine. If, however, it is desired to replace any coil with a new one, it is a matter of only a few minutes' work to accomplish this. The insulation of the machine as a whole is carried to the highest degree possible, consequently these machines can be relied upon to last for an indefinite period without any probability of repair expense.

The general design is such that the armature is protected on all sides by the frame of the machine, and the metal flanges of the field spools, while its compactness necessarily requires smaller floor space and less head room than any other machine of equal capacity. All generators are compound wound to give any desired increase in voltage up to 15 per cent. at full load.

The under side of the bed of each machine has grooves planed in same so that the machine can be mounted on slides for taking up slack in belt; or, if it is desired to hold the dynamo in a fixed position, the lugs, which are cast on sides of bed-plate, near the grooves, can be used for bolting the machine down to the foundation. The dynamo shown has a motor headboard on same, which simply provides the necessary terminals for connections. On headboard of generator there is also provided, in addition to these connections, a double pole quick-breaking headboard switch, so that when desired, and entirely independent of the switchboard appliances, the machine can be entirely disconnected from the mains.

These dynamos have a fixed point of commutation, which renders possible the reversing of the machine and changing of load, from no load to full load, without any sparking whatever being noticeable at commutator.

In designing this machine the advantages of slow speed have been kept in view, also the matter of efficiency. As a result, the machines of this type average a slower speed than any other machines of equal capacity, while their efficiency compares favorably with any.

The standard sizes of the machines now being made are as follows, ratings being made in kilowatts: ⅛, ¾, 1½, 3, 5, 7½, 9, 15, 20, 30, 40, 60 and 100. Larger machines of the multipolar type will soon be brought out.

The Detroit Electrical Works have already received orders for machines as follows: *Times* building, Chattanooga, Tenn., two 30 kilowatt generators, one 9 and one 15 kilowatt motors; Bagley Estate, Detroit, one 40 kilowatt generator and five 9 kilowatt motors. This contract also includes five freight elevators and controlling devices for motors, so that each elevator is operated by one 9 kilowatt motor, which is controlled, started and stopped by means of the starting rope of the elevator, the motor only running when the elevator is in use.

Detroit Dry Dock Company, Detroit, two 250 light generators for lighting machine shop, boiler shop, dry dock, engine rooms and offices. One 40 kilowatt generator to furnish current for electric cranes.

Also Detroit Dry Dock Company, for boats which they are building, one 125, one 150 and one 250 light plant, complete.

Detroit Foundry Equipment Company, Detroit, one 9 and one 15 kilowatt motors, complete, with controlling devices, etc., for electric cranes.

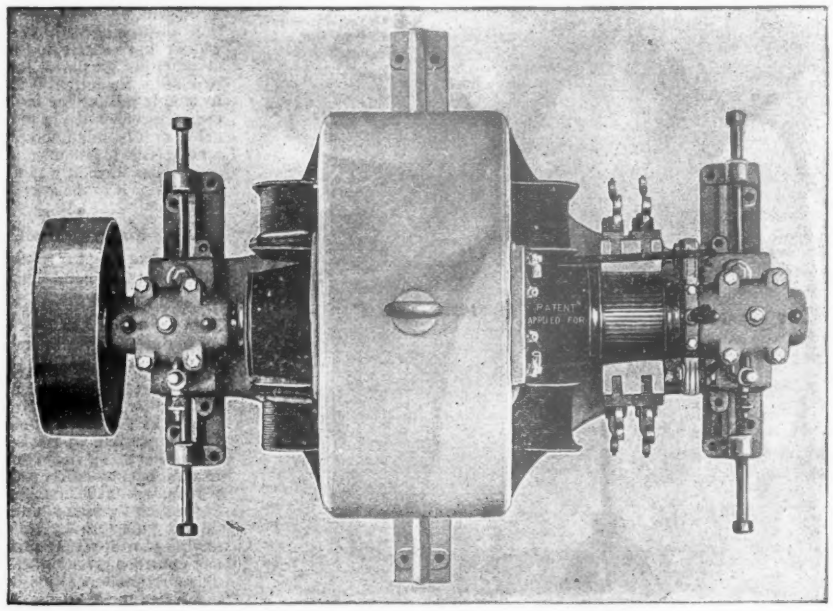


FIG. 1.—PLAN VIEW OF DETROIT ELECTRICAL WORKS' NEW DYNAMO.

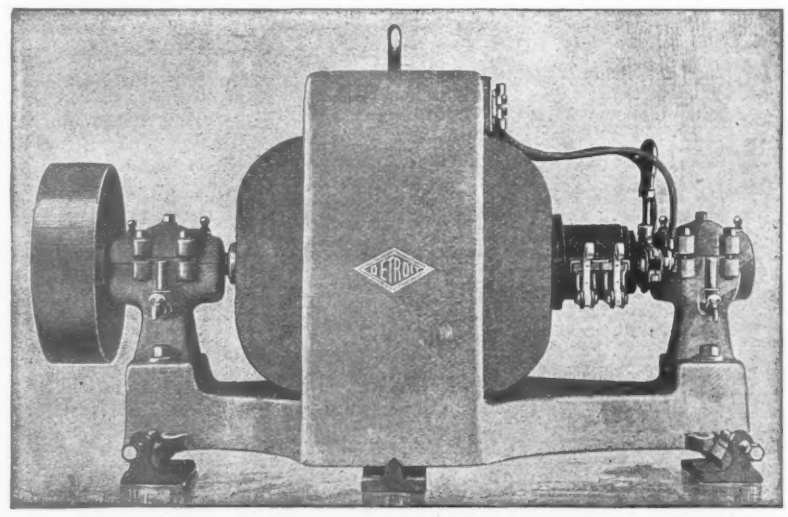


FIG. 2.—SIDE ELEVATION OF DETROIT ELECTRICAL WORKS' NEW DYNAMO.

Pacific Telephone and Telegraph Company.

We have received a handsome photograph showing the exterior of the Pacific Telephone and Telegraph Company's office at 700 Market street, corner Kearney, San Francisco. Numerous signs inform the passer-by that the office is equipped with direct wires to all points and has private conversation booths. Another sign reads: "Public conversation room now open for business." The office is lighted by electricity.

OBITUARY.

Ex-Judge Morris Fosdick, one of the oldest and wealthiest citizens of Jamaica, L. I., died at his home there June 27, aged 78 years. He was a stockholder in the Brooklyn and Jamaica Electric Railroad, and a director in the Jamaica Road. He leaves a fortune estimated at $500,000.

A Painful Error.

"I got a dreadful shock at that 'phone yesterday."

"What was it—lightning?"

"No, no—the telephone girl. She thought it was the office boy!"—*N. Y. Sun.*

The Westinghouse Electric and Manufacturing Company has brought suits against the Duquesne Traction Company and the P., A. & M. Traction Company, of Pittsburgh, for infringing the Finney patent on the overhead trolley system. The papers in the suits were filed late last week.

Employ Efficient Dispatchers.

It would be a good thing, says the *Railroad Gazette*, if the superintendents could frankly discuss certain matters concerning the conduct of train dispatchers' offices, which are closely connected with the grievances which these dispatchers have, or expect to have. They are matters which ought to be aired whether dispatchers feel aggrieved or not.

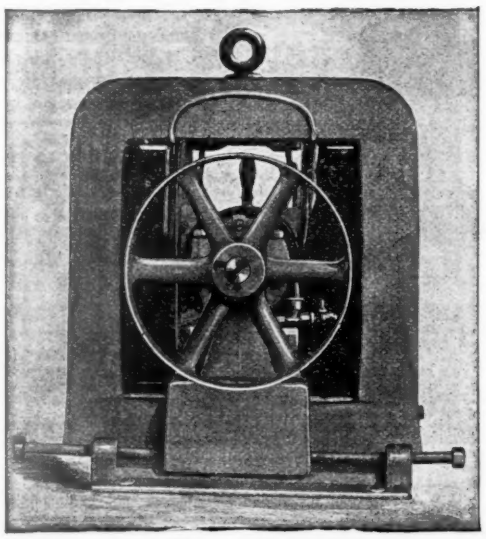


FIG. 3.—PULLEY END ELEVATION OF DETROIT ELECTRICAL WORKS' NEW DYNAMO.

For instance, suppose the chairman of the appropriate committee should ask each member some one or all of the following questions: Why do you employ such young persons, almost boys, as dispatchers? Is it chiefly because they are satisfied with lower pay than more experienced men would accept? Why do you let these comparatively inexperienced dispatchers run their offices so entirely according to their own notions, instead of following them up so closely that they will be compelled to follow the rules rigidly every day?

Why do you work a man at dispatching eight hours a day (on a wire where that amount of work is enough for one day) and then have him work an hour or two at other work? Is that fair? What do you think of appointing, to a position like this, a man who knows nothing about good discipline; who knows neither how to command or obey? Orders have to be given every day to enginemen and conductors who have grave, yes, exciting responsibilities, and who ought to be treated with the consideration due to gentlemen; you treat them as gentlemen yourself, as a matter of course; do you take care to see that the dispatchers do the same? Probably you can tell of some of your neighbors' roads where dispatchers are overbearing, or childish, or ignorant, constantly annoying the trainmen. Do you investigate all the butting collisions that you hear of, and find out about the dispatcher who, though the blame is, according to the rules, laid upon the trainman or operators, might have prevented the blunder that those men made if he had only exercised the ordinary degree of foresight that any experienced conductor or engineman would have exercised?

These are some of the questions which a good many superintendents would like to see asked. They would take great interest in the way different members answered them. Butting collisions constitute the most notable disgrace to American single track railroads, and the dispatcher's office should be made perfect on every road. The highest attainable human perfection may not afford the requisite safety with the present dispatching plan, which, as a plan, is probably the best that can be devised, but the effort to reach a high mark will serve a good purpose nevertheless. It will show in a clearer light the use of supplementing the best dispatching system by a block signal system, as a number of roads have done.

Why the Electric Lights Failed.

In Dexter the other evening the electric lights did not commence business at the usual hour, and the people could not understand it. It became dark and darker, and traders were fretting. At last the manager of the company harnessed up and drove down to the power station, two miles below the village. The station was brilliantly illuminated, and the assistant sat comfortably therein reading a book. At the somewhat heated inquiry of the manager the other's face dropped. He jumped to the switch and ejaculated: "Thunder! I forgot to turn the lights on." He had been running the dynamo two hours for his own personal illumination. —*Bangor, Me., Commercial.*

A Great Engineering Enterprise in Japan.

The last mail from the Orient brings a very interesting account of the completion and successful operation of a great government work in Japan, says the *Engineering and Mining Journal*. Lake Biwa, having an area of 500 square miles, is located seven miles from the city of Kioto, and at an elevation of 143 feet. A navigable canal has been cut from this lake to Kioto, involving two miles of tunneling and an aqueduct of considerable length. At the eastern extremity of the city, to which point the canal has been brought, there is a sharp decline of 118 feet, from the base of which the canal is continued to the sea. This difference in level is overcome by inclined plane ways 2,100 feet in length, on which boats are raised and lowered from one canal to the other. These ways are operated by electric power furnished from a Pelton water wheel connected with a Sprague motor. The fall above named affords also a very valuable water power, a part of which has already been used for various mechanical purposes by means of electric transmission. The power station is located at the foot of the incline, and consists of three eight feet and two six feet Pelton wheels, aggregating about 600 horse-power, which are supplied with water from the high level canal by three lines of 36 inch pipe 1,300 feet in length, delivering water to the wheels under a head of about 100 feet. These wheels are at present operating three Edison dynamos of 80 kilowatts each, the power from which is distributed about the city within a radius of two miles, running rice mills, spinning mills, a watch factory and various other machinery. One Thomson-Houston alternating current dynamo of 2,000 volts supplies the city with 1,300 incandescent lights, as well as many arc lights. The above works, involving an expenditure of $1,500,000, were planned by and executed under the direct supervision of Mr. S. Tenabe, an eminent Japanese engineer, and their operation is said to be a great success, both from a mechanical and financial point of view.

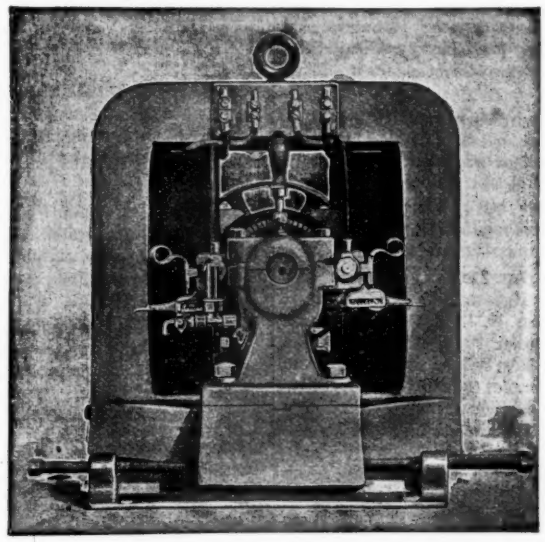


FIG. 4.—COMMUTATOR END ELEVATION OF DETROIT ELECTRICAL WORKS' NEW DYNAMO.

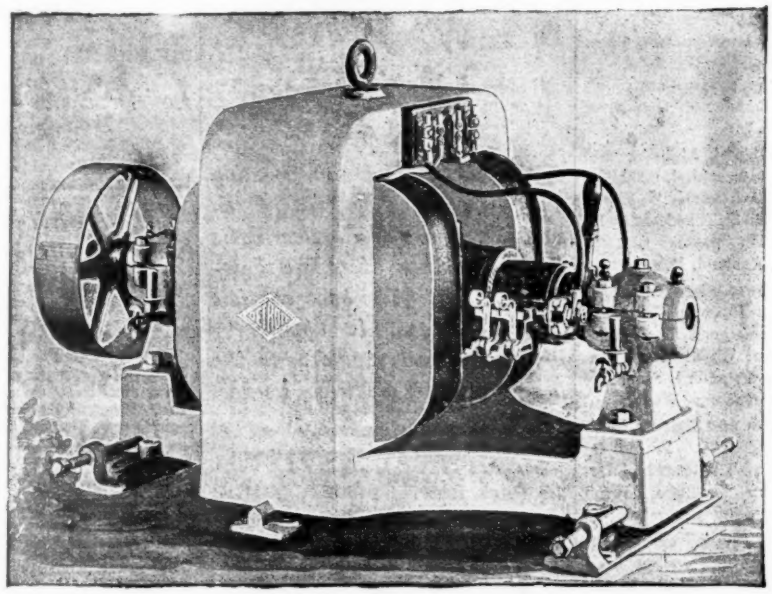
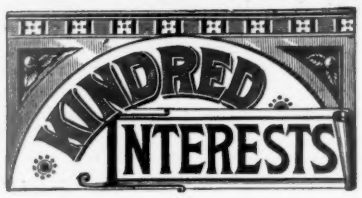


FIG. 5.—PERSPECTIVE VIEW OF DETROIT ELECTRICAL WORKS' NEW DYNAMO.

The Future of Electricity.

"Since, in obtaining power from fuel by means of steam engines, upwards of 90 per cent. is wasted in unused heat, while the power obtainable for use represents scarcely more than 10 per cent. of the real value of the fuel, under the very best conditions, the question arises whether there may not be discoverable a plan whereby a much larger percentage of the real value of the fuel may be turned to account as electricity, and, through the latter, as heat, light or power," says Professor Elihu Thomson, the eminent electrical inventor and expert, in the July *New England Magazine*. "This question has at present no answer. The subject has been alive in the minds of our most able engineers and inventors for years, and some have striven hard to find a solution to the problem. Records of scientific discovery have been earnestly ransacked to find some clue, or, as it were, a guiding post to point the way for the uncertain explorer. It now appears that we may be compelled to await some new discovery, some new adaptation, or some new generalization, before the way to the much desired solution may be found. The effect on the general industrial and economic development in electricity which would follow the discovery of some not too complex means for realizing an economy of even 40 or 50 per cent. of the energy value of fuel is indeed almost incalculable. Then truly would electricity become the almost universal agent in the production as well as the transmission of power. The steam engine would go out of use almost entirely. We should burn our coal, not under steam boilers; it would be consumed in electric generators. Our steamships would have their machinery replaced by such generators, and their propellors would be turned by gigantic electric motors, connected with the generators. The speed would be increased so as to still further shorten the time of an ocean voyage. The uses of electricity as a heating agent would be vastly extended, and it goes without saying that our lighting would be accomplished at much less cost."

The alteration of the Westinghouse Air Brake Company's property in Allegheny to accommodate the extension of the Westinghouse business has begun. The Newark establishment will be hereafter operated as a branch from Pittsburgh, and it is expected to turn out 10 motors daily, making the total capacity of the company on street railway motors 140 to 150 per week.



The Gethins Electrical Manufacturing Company, 620 Atlantic avenue, Boston, have sent out a new and well prepared catalogue of general, battery and motor supplies.

The Railway Equipment Company, Chicago, have removed to permanent and more convenient offices and store rooms on the ground floor of the Michigan avenue side of the Pullman building.

Catalogue No. 18, Ball Electric Company, 404 West Twenty-seventh street, New York, is a very attractive and interesting one, just issued by the Ball Company. Every one who sends for it will get a copy.

The Edison Manufacturing Company has removed its office from 44 Broad street to 110 East Twenty-third street, New York, where in the future all business of the company will be conducted. Correspondents are requested to address all correspondence to the new office.

Ball Engine Company, Erie, Pa.—The North Hudson County Railroad Company, Hoboken, N. J., in March purchased a 300 horse-power latest improved Ball engine. They have been so well satisfied with the performance of the engine that they have ordered an additional engine of the same power from the same company. The Englewood Electric Light Company, Englewood, Ill., have ordered a 500 horse-power latest improved Ball cross compound engine through the Chicago office of the Ball Engine Company. The Port Huron Electric Railway Company, Port Huron, Mich., have awarded an order for one of their latest improved engines to the Ball Engine Company. The engine is a 400 horse-power cross compound of the latest type.

The Ashton Valve Company, 271 Franklin street, Boston, issues the following notice: We would announce to our customers and friends, and to the trade generally, that we have bought the entire plant, material and business of the Boston Steam Gage Company, together with a series of valuable patents, and have consolidated their business with our own. We have secured the services of the former manager of their business, Mr. H. L. Willard, long and favorably known to the trade, and bespeak for him the same consideration in this new connection that has been so kindly extended to him in the past. We shall manufacture all classes of steam pressure and vacuum gages, hydraulic gages, water pressure and ammonia gages, and all similar instruments used in connection with steam plants, being more particularly the sole manufacturers of the Boston patent steam gage. The reputation gained by nearly 20 years' experience in the manufacture of safety valves, and the widely recognized quality of the product of the Ashton Valve Company, will be the only guarantee needed for the unsurpassed quality of the goods we shall put upon the market.

The Boston Office of the General Electric Company reports recent sales as follows: Johnston, Gloversville and Kingsboro Horse Railroad Company, original equipment, four car equipments consisting of eight WP-30 motors and two D-62 generators; Lake Roland Elevated Railway Company, Baltimore, Md., original equipment, 50 Edison No. 16 double motor car equipments; Binghamton and Port Dickenson Railroad, Binghamton, N. Y., original equipment, 12 WP-50 motor equipments; City and Suburban Railway Company, Baltimore, Md., original equipment, 50 double motor WP-50 equipments and two MP-200 generators; Syracuse Consolidated Street Railway Company, Syracuse, N. Y., additional equipment, four sets of the new series parallel controller; Chillicothe Electric Railway and Light Company, Chillicothe, Ohio, additional equipment, eight Edison No. 14 car equipments, one 100 KW generator; St. Louis and Suburban Railway Company, St. Louis, Mo., additional equipment, 30 double motor WP-50 car equipments; East Cleveland Railway Company, Cleveland, Ohio, additional equipment, one set of the series parallel controller; Savannah, Ga., additional equipment, 24 WP-50 single motor equipments, two MP-200 generators.

NEW INCORPORATIONS.

Cairo, Ill.—The Delta Electric Company; capital, $150,000. Promoters, Henry Hasenjarger, Wm. Kluge, Harris Schulze. Incorporation papers sent to H. Schulze, Cairo, Ill.

Chicago, Ill.—Northern Light Company; capital, $100,000. Promoters, William W. Hutchinson, Lewis Lusk, A. C. Barnes. Incorporation papers sent to Lewis Lusk, Antigo, Wis.

Rutland, Vt.—Bristol Electric Company; capital, $15,000. Promoters, Rockwood Barrett, Edward Dana, Homer N. Dyer. Incorporation papers sent to Rockwood Barrett, Rutland, Vt.

Chicago, Ill.—Pontiac Water, Light and Power Company; capital, $60,000. Promoters, John J. Hainsworth, W. G. Reeve, H. Ream. Incorporation papers sent to W. G. Reeve, Princeton, Ill.

Hartford, Vt.—Hartford Electric Light and Power Company; capital, $12,000. Promoters, Allen L. Pease, Joseph F. Whiting, Alfred E. Watson. Incorporation papers sent to Alfred E. Watson, Hartford, Vt.

Sumner, Wash.—Valley Light and Water Company; capital, $50,000. Promoters, Geo. H. Ryan, P. D. Rice and Geo. Herriott. Incorporation papers sent to Mason Mortgage Loan Company, Tacoma, Wash.

Hollidaysburg, Pa.—The Hollidaysburg Electric Light and Power Company; capital, $23,000. Promoters, F. H. Russ, W. F. Taylor, A. J. Anderson. Incorporation papers sent to Woodcock & Clark, Altoona, Pa.

Kankakee, Ill.—The North Kankakee Electric Light and Railway Company; capital, $30,000. Promoters, J. H. Hardeback, Walter W. Hatch, August D. Ehrich. Incorporation papers sent to Edward E. Day, Kankakee, Ill.

Chicago, Ill.—North American Gas Company; capital, $500,000. Promoters, Chas. M. Hill, John D. Cameron, James R. D. Graham. Incorporation papers sent to John D. Cameron, 1304 Chamber of Commerce Building, Chicago, Ill.

Ashland, Wis.—Ashland Lighting and Street Railway Company; capital, $200,000. Promoters, Thomas Barrton, G. W. Harrison, G. H. Hopper, S. S. Fifield, John H. Knight. Incorporation papers sent to Thompkins & Miller, Ashland, Wis.

Everett, Wash.—Port Gardner, Lake Stevens and Eastern Railway Company; capital, $250,000. Promoters, John F. Hart, J. M. Davis, Tacoma, Wash. Incorporation papers sent to Pritchard, Stephens, Grosscup & Seymour, Tacoma, Wash.

Newport, N. H.—Newport Electric Light Company; capital, $15,000. Promoters, Seth M. Richards, Wm. T. Richards, Martin L. Whittier, Arthur B. Chase, Myron W. Tenney. Incorporation papers sent to Col. Seth M. Richards, Newport, N. H.

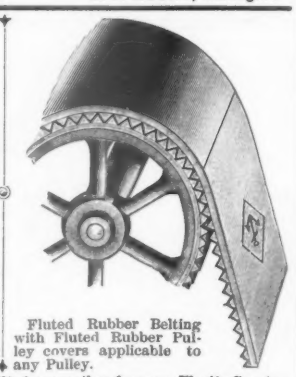
San Francisco, Cal.—San Francisco Electric Storage Company; capital, $1,000,000. Promoters, D. Gilbert Dexter, C. B. Sessions, S. C. Mills, H. W. Spalding, E. J. McCutchen. Incorporation papers sent to Wilson & McCutchen, San Francisco, Cal.

Waitsburg, Wash.—Waitsburg Light and Power Company; capital, $25,000. Promoters, George H. R. Preble, John C. Onderdonk, Spokane, Wash.; J. H. Morrow, P. A. Preston, Waitsburg, Wash., and J. R. McKinley, New Whatcom, Wash. Incorporation papers sent to John C. Onderdonk, Spokane, Wash.

THE NEW YORK OFFICE of the Consolidated Electric Storage Company, 120 Broadway, is the sole agency for the sale of storage batteries for New York and vicinity. Purchasers desiring to secure the best terms should apply at that office to

E. J. MOORE, Manager.

THE PERFECT DYNAMO BELT FOUND!



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Patented and as cheap as any first-class Belt.
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MINERALIZED RUBBER CO.,
18 Cliff Street, New York.
Agents Wanted.

MACHINERY IN STOCK.

Engine Lathes, 10 in. x 4 ft.; 11 in. x 5 ft.; 12 in. x 6 ft.; 14 in. x 6 ft.; 16 in. x 6 ft.; 18 in. x 8 ft.; 20 in. x 8 ft., with tapes attachment; 22 in. x 12 ft. and 14 ft.; 24 in. and 26 in. x 16 ft.; 30 in. x 10 ft. and 18 ft.; 36 in. and 38 in. x 20 ft.; 42 in. x 12 ft.; 27 in. x 32 ft.; 88 in. x 31 ft.; 96 in. x 20 ft. Fox Lathes, 13 in. x 5 ft.; 14 in. x 5 ft.; 15 in. x 6 ft.; 18 in. x 6 ft. Turret Lathes, 12 in. x 5 ft.; 14 in. x 5 ft.; 15 in. and 16 in. x 6 ft.; 18 in. x 6 ft.; 36 in. x 8 ft.
Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 44 in. x 48 in. x 22 ft.; 60 in. x 49 in. x 24 ft.
Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.
Crank Shapers, 6 in., 8 in., 10 in., 12 in., 13 in., 16 n., 17 in., 20 in., 24 in., 28 in.
Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.
Screw Machines, Nos. 5, 6, 7, 8, Power Feed.
Presses, Nos. 51, 52, 53, Ferracute; Nos. 1, 2, 3, Stiles & Parker.
5 Lincoln Pattern Millers, No. 2.
Hand Millers, Nos. 1 and 2. 3 Cam Cutters.
Bolt Cutters, ¼ in. to 1 in., ½ in to 2 in.
2 Profiling Machines. 1 36 in. and 48 in. Gear Cutter.
C. D. and E. Horizontal Boring Machine. Newark Machine Tool Co.
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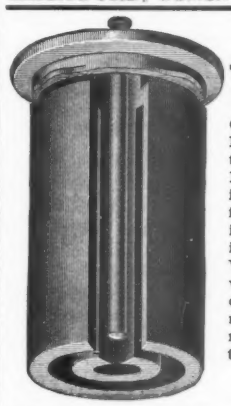

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